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Installation Practice

Afterthoughts on the I.E.E. Regulations

RULES and regulations stand little chance of wholehearted acceptance unless those who should abide by them are convinced that they are likely to achieve the best results in the best way. This applies even to directions that can legally be enforced and still more, therefore, to codes, such as the I.E.E. Wiring Regulations, which are without statutory backing.

Methods and materials once regarded as good for their purpose inevitably become out of date, but a natural conservatism prevents their being relinquished, except with great reluctance, in favour of something better. Moreover, well-founded pride in the possession of special skill and experience may of itself tend to make individual trees more visible than the whole wood. It may, indeed, even cause some of the men responsible for the practical application of the rules to regard the lawgivers as too Olympian for the rough and tumble of everyday life. A glance at the list of members of the I.E.E. Wiring Regulations Committee will convince the reader that they are all men with practical acquaintance with installation work. Nevertheless, complete understanding of the reasons underlying the Regulations would be a good thing for its own sake as well as a valuable education.

New Materials and Methods

It is, of course, easy to demonstrate that the eleventh edition of the Wiring Regulations, although a distinct advance on its predecessors (the tightening up of the conditions for the use of flex is only one instance), is capable of improvement. Future editions will also be imperfect—unavoidably so, as long as research continues to place new materials and technique at the disposal of the electrical industry. As an example, certain types of material have been known favourably for some time, but installations in which they were included could not be said to comply with the Regulations until they could be referred to in a new edition. Yet the last thing intended is to discourage the development of new materials, appliances and methods.

More easily rectified are defects and inconsistencies in presentation, such as those pointed out by Mr. H. R. Taunton in his articles which appeared in our pages after the publication of the eleventh edition in June. Many of his criticisms were directed against the involved wording. He maintained that the Regulations could be abbreviated and as such without sacrificing their value as precisely defining agreed conditions that could be quoted in the Courts. Simplification would also enable the ordinary practitioner to follow them more easily.

The Regulations are not intended as a detailed specification, and much has to be left to the intelligence of the installation engineer. Nevertheless, there are a large number of items which are still regarded as "contentious," as was proved in the discussion on the recent lecture given by Mr. E. A. Reynolds to the Association of Supervising Electrical Engineers.

Earthing and Insulation

Much remains to be said about earthing, earth-free situations and all-insulated systems, for instance. Diversity, too, about which a good deal of misapprehension exists, raised several pertinent questions, such as its bearing on the efforts to increase the number of socket outlets to suit any later disposition of furniture, although only a small proportion of them would be used at one time. Also, can it be said that due account is taken of the popularity of the 2-kW fire in the rating of socket outlets and of the conductors connected to them?

Perhaps one of these days diversity will be settled by the elimination of the rewirable fuse in favour of control arrangements that will automatically limit the amount of current carried by a circuit. Incidentally, are fuses in circuit neutrals really necessary, or even desirable, where the supply system neutral is earthed? Their omission would probably increase the attention paid to the prohibition of single-pole switches in the neutral—one of the most important safety provisions of the Regulations, yet one that is often lightheartedly ignored.

These comments do not take into account anything like all of the points brought up during the discussion and during other and more informal discussions we have heard. The latter could have taken place before and not after the issue of the Regulations if an appropriate organisation, such as an Installation and Utilisation Section of the I.E.E., had been in existence. It is to be hoped that there will be something of the kind for discussing the next edition of the Regulations in draft, as

is done in the United States, as Mr. Taunton mentions in the course of his article on page 759 of this issue. Criticisms nowithstanding, the essential thing is that the Regulations should be the recognised means for ensuring safe and sound installation work. Towards that end the courage of the E.C.A. in taking the risk (a risk it certainly seems to be) of favouring the certification of an installation as complying with the Regulations is a most valuable support.

I.E.E. Meetings Again

LONDON members of the Institution of Electrical Engineers will welcome the decision to restart technical meetings (though not major social functions) early in the New Year, provided, of course, that the war situation then makes this permissible. In any case, adequate air-raid shelters are said to be available. All meetings will begin at 6 p.m. At the first ordinary meeting, on January 25th, Messrs. H. W. Swann, J. Hacking and R. A. McMahon will open a discussion, illustrated by a coloured film, on the E.R.A. report in the December *I.E.E. Journal* on the (unfortunately) topical subject of fire-figgting equipment for electrical installations. That the whole time will be available for discussion is all to the good, as, while circulation of copies of papers has proved a most useful service (and one which might well be continued for the benefit of members unable to attend meetings in present conditions), members have missed the play of minds in the discussions. Whether in the constructively critical aspect or in the approach to the subject from different angles, these discussions add immensely to the value of the original papers.

Illumination Measurement

How closely electrical engineers who wish to be ahead of events have to keep informed of work in other fields is well exemplified in the publication of the abstracts of papers emanating from the National Physical Laboratory in 1938. (Stationery Office, 1s. net.) While only eighteen of the 119 papers included come into the electrical section, there are few of the remainder that do not repay study in the brief form in which they are presented. Of especial interest at the moment is the reference to the portable illumination meter using the emission type of photo-cell with valve amplification, which is described by J. S. Preston as capable of measuring illumination as low as 0.005 ft.-candle to an accuracy of ±1 per cent. That is an excellent piece of work, but values of 0.002 ft.-candle have been prescribed in B.S. Specifications, and how would the 0.0005 ft.-candle, which has been mentioned as a possible allowance for street lighting, be measured?

Lack of Cohesion

AN editorial in the *Electrical World* of November 18th entitled "Too Much Distrust" prints a picture of the unsatisfactory relationships which exist between the various branches of the American electrical industry. It says that if electrical utilities suggest any change in the National Electrical Code or explore the possibilities of a new appliance designed to meet the low-income market, opposition springs up from the other interested branches. Manufacturers in developing a market programme have met with all sorts of obstacles from utilities. Contractors are looked down upon by every other branch of the industry; their co-operation is solicited in a rather perfunctory way and given in a considerably lesser degree. Our contemporary asks: "Why cannot the utilities see that their strongest bulwark against political agitators is the rest of the industry? Why cannot those others see that their greatest opportunity for business and employment comes from privately operated utility service free to expand without fear? . . . It is our firm belief that somewhere there should be set up an organisation that represents not just manufacturers, or utilities, or contractors, &c., but the *electrical industry*." Where have we heard something similar before?

Reduced Mains Staffs

RESTRICTIONS on extensions of electricity supply systems have naturally led to a reduction in cable laying. This has resulted in an apparent redundancy of mains staffs and some undertakings have adopted a policy of cutting down their staffs to what may be a dangerous degree. Although there may be little work for them at present it is wise to keep as many of them as possible, for if an emergency arises they of all men will be most valuable. Another consideration is that these men are "reserved" and will find it impossible to join the Services. If they are forced into other occupations they will be lost to the supply industry which, later on, may actually experience a shortage of skilled plumber-jointers, overhead linesmen, etc. Supply authorities should seriously consider whether the small expense saved by the dismissal of mains staff is worth the risk and trouble which may be caused thereby.

High-voltage Generation

WHAT was considered eleven years ago as undoubtedly a bold move in the installation of the first 33-kV alternator by the Northmet Co. at Brimsdown has proved to be amply justified by results, as the large number and high individual outputs of such machines in commission all over the world amply demonstrate. Confidence in their reliability is enhanced by the I.E.E. paper of Mr. W. D. Horsley in which their merits stand out against a background of frank discussion of the difficulties that have been encountered and the methods by which they have been overcome. One of the most important of the early problems, which was probably not expected to loom so large, was that of over-potential due to neutral inversion or displacement of the neutral caused by a complex form of resonance, the principles of which formed the subject of a contribution by Mr. B. G. Gates to the I.E.E. *Journal* in March, 1936. The trouble arose from the earthing of the sets through the neutral points of voltage transformers, but a remedy was found in earthing the alternator neutrals through resistances or reactances of low value. There are, however, several other ways, as Mr. Horsley shows, of securing immunity from this form of neutral instability that is quite apart from that which arises out of system faults.

Arc-Suppression Coils

TWO papers in *Electrical Engineering* (the American I.E.E. Journal) for November deal with the use of Petersen coils on transmission systems. One of these discusses experience with the 66-kV lines of the Metropolitan Edison Co., and shows that during the first year of operation of the coils two-thirds of the faults were cleared without the circuit-breakers opening. In the second paper emphasis is laid on the value of a low rate of rise of recovery voltage across the arc terminals, which the author (Mr. A. R. Eaton) regards as possibly of even greater importance than keeping the value of the current in the arc at a low figure. As a result of the growing record of experience and studies of this kind his view that the effectiveness of a Petersen-coil system will be predictable before it is built would appear to be well within the bounds of possibility.

Capacity Regulation

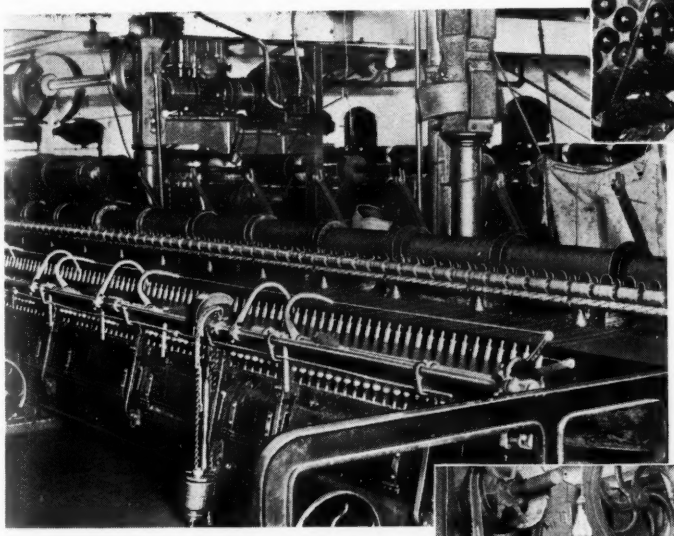
AS a reservoir of electrical energy which can be released at any required rate, the condenser ought to find scope in providing time lags in control circuits. Its time constant being a function of the microfarad capacity and the ohmic resistance in circuit, the rate at which energy is released is easily adjustable over a wide range for the energising of coils of relays or the neutralisation of inductances. Several new uses of condensers in this way are suggested in the American *General Electric Review* for November, but many others immediately suggest themselves. An outlet for ingenuity in devising novel methods for control of industrial apparatus of all kinds seems to be indicated here.

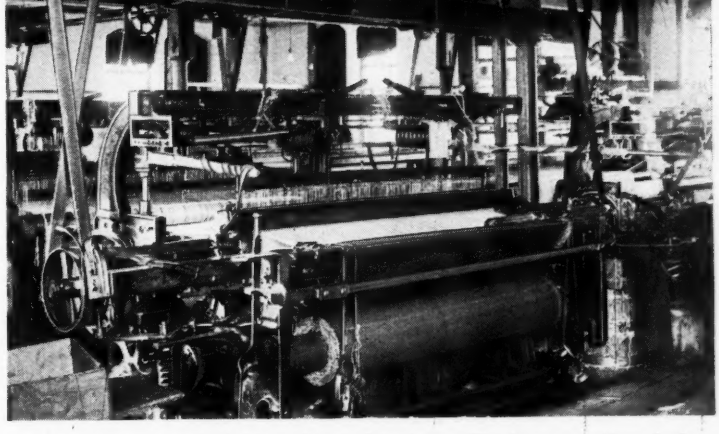
TEXTILE MILL CONVERSION

From Steam to Electric Drive

CHANGEOVER from steam to electric drive at the Morley cloth mills of Humphrey Bradley has helped considerably in the work of the mills in producing 25,000 yards of cloth per week. This output involves the use of 490 HP of motors and represents a 10 per cent. increase over that which was permitted previously by group driving from a 300-HP steam engine, supplemented by 180 HP of single-phase motors. With the changeover of the public supply to three-phase, the opportunity was taken to convert the complete mill installation to modern electric driving, and the neat and efficient manner in which this has been done reflects great credit on all concerned.

All the motors are by Brook Motors, Ltd., whose special self-contained V-belt reduction units have played an important part in overcoming the many problems of adaptation to existing shafting and machinery. Supply is taken at 400 V from the electricity undertaking and primary distribution is *via* a 500-A Ellison main circuit-breaker and 400-V power and 230-V lighting switchboards equipped with "Rex Glasgow" iron-clad switch-fuses and bus-bar changers, built up on iron frames. Prentice iron-clad fuseboards about the factory provide for sub-distribution. The installation work was carried out by Messrs. F. W. Rhodes.

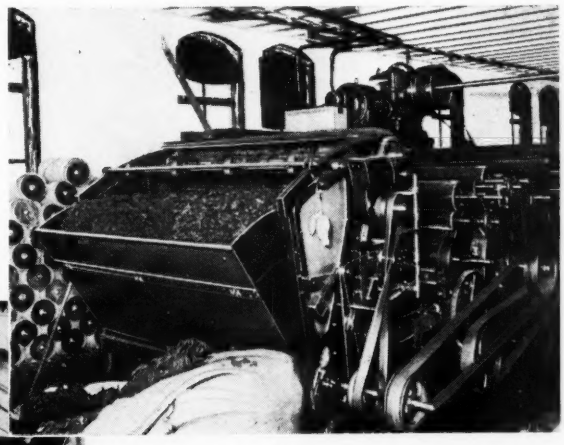




Above: Two 25-HP motors in the spinning room each drive four mules. Right: A 25-HP motor serves two lines of looms (one in the room above) from one lineshaft

The factory raw material—graded cloth rags—is received in bales. After being blended down in a pile of about three tons at a time, when it is served with oil to facilitate subsequent processes, it is "pulled." Rags laid singly on the server (endless conveyor) of a pulling machine are fed under the swift, a high-speed roller with teeth which pull the rag into thread, and a fan on the pulling machine blows the thread into a nearby chamber or blow hole. A 20-HP motor has multiple V-belt transmission on to the swift shaft which also serves as a countershaft to the fan. The motor and swift speeds are 1,500 and about 520 RPM, respectively, and there is a speed increase of about 1 to 3 from the swift to the fan. Direct-on-line started by an Ellison oil circuit-breaker, the motor, like many others in the installation, is totally enclosed, surface cooled, to avoid trouble from the fluff. To provide for different swift speeds required for different blends of material the rim of the motor V-pulley is detachable, so that alternative sizes can be fitted and consequent variation in the rope length is provided for by sliding the machine itself along bed-plate rails.

In sheets—long sacks with the opening lengthwise to permit trampling—the material (called mungo at this stage) is transported to willeying machines for the next process. This opens out the threads more and is

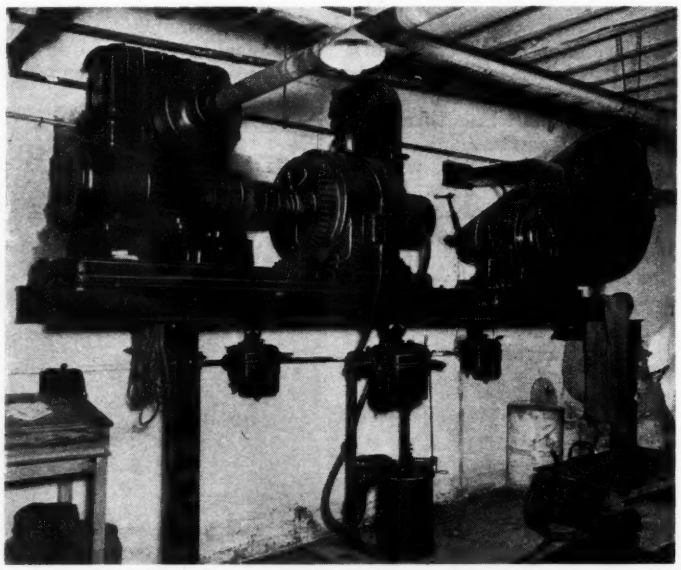


Scribbling and carding machines comb the fibres out in one direction; 40-HP group drive for eight machines

similar to pulling, but the swift has bigger teeth. The drive for this machine is a 10-HP motor inverted and suspended from slide rails on the ceiling, with a short V-belt reduction from 1,000 RPM to 120 RPM at the shaft and then a speed-up by straight belt to about 700 RPM at the swift shaft. The material is subjected to two willeying operations before and after further blending and a fan attached to the machine blows the stuff either to the blending bed or to a feeder for sheeting, again for transport to the next process, which is known as scribbling.

From a hopper on each scribbling machine the

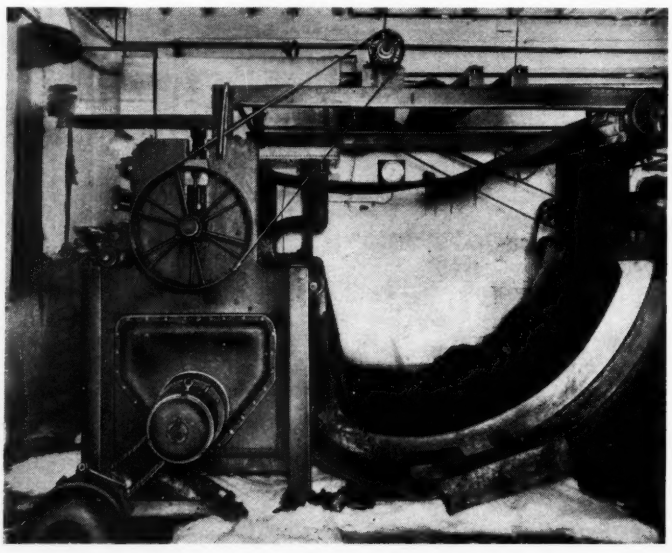
material is automatically weighed out to permit a uniform thickness of the material to be carried through the scribbler. This machine has about 35 rollers, each covered with wire teeth, and the material is passed through from one roller to the next. The operation is actually one of combing the fibres out in one direction. The fibres are removed from the last roller of the machine by a fly comb, which has a very fast up and down reciprocating motion, and delivered to a conveyor (server) which feeds them to a cotton crusher in which all-cotton thread is extracted, leaving only the required material—wool. The cotton is actually crushed to powder under great pressure between steel rolls and falls through the conveyor. Wool is not damaged by the pressure.



A 60-HP motor for twelve milling machines and a 30-HP motor for five scourers

At the end of the machine the fibres are first collected in a trough in the form of a thin fibre sheet to be immediately bunched from side to side and carried over the rollers of a scotch conveyor to a carding machine the operation of which is very similar to that of the scribbler, except that the combing is much finer. From the rolls of the carder the loose fibre sheet is delivered to a condenser in which the material first takes the form of soft thread or slubbing. In the condenser, conversion of the material takes place during its passage over rubber rollers which also have a side-to-side reciprocating movement. Finally, at the delivery end of the machine, the thread is wound on to the condenser bobbin.

Each scribbler and its cotton crusher may be regarded as one machine and so may each carder together with its condenser. In one room there are 16 machines, 8 scribblers and 8 carders, with two group drives. For each a 40-HP slip-ring protected motor is directly coupled to a Croft reduction unit from which the shaft is belt driven. Transmission from the shaft to the machines is also by belt. The motor, shaft and machine speeds are 1,000, 110 and (about) 80 RPM, respectively. The motor and reduction unit are mounted on a common bed-plate, the whole being wall mounted as an excellent space-saving scheme. The motor control is by means of an Ellison drum-type starter and oil circuit-breaker.



In the open-width washing machine the soap is removed from the cloth

The product of the carding machines is next converted into hard thread on mule spinning machines, the draw-out of the frame reducing the thread to the correct thickness, while twisting imparts the necessary strength. On some of the machines the thread is wound on to weft bobbins and on others it is wound on to cops for making into warps.

Two motors in the spinning room each drive four mules, the driving arrangements being similar to those of the carding equipment, except that the motor is smaller, 25-HP, and the combined motor and reducing unit is mounted on a bracket on a building stanchion. The motor and shaft speeds are 1,000 and 135 RPM respectively.

Warp cops from the spinning room are introduced to the warping mills on the large winding wheels, or balloons, on which are arranged the necessary number of threads and the required length of the warp. From the balloon the threads are wound in the same formation on to the weaver's beam at the back of the mill. Each warping mill is driven from a 1½-HP 1,000-RPM inverted motor mounted on the ceiling structure with a V-belt reduction unit which gives a very low speed at the balloon.

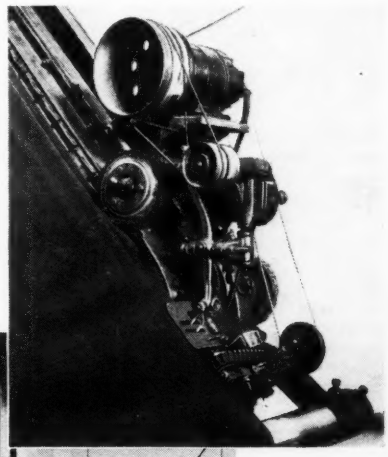
Weaving is the next operation and on the looms the weft from the spinning mules and the warp from the warping mills again meet. While the threads from the beam are drawn through the loom and subjected to their alternate up and down movements the weft is shot across the loom under the influence of the picking arm to give the cross-lacing effect at the required moment.

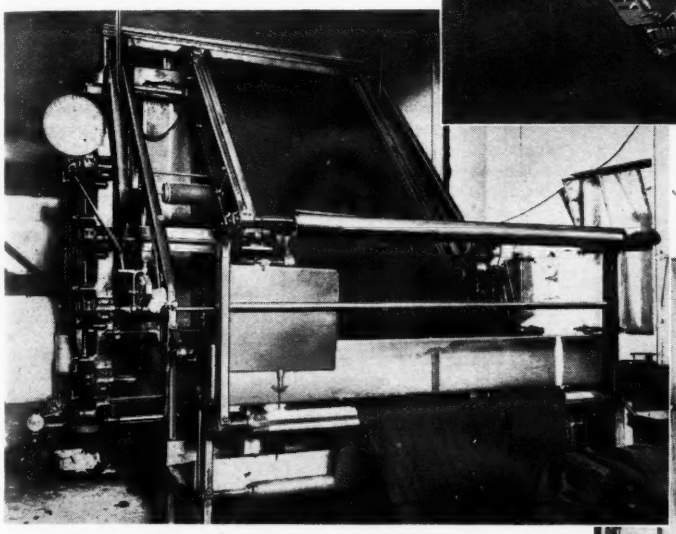
In one room there are three lines of looms—eight machines on one line and six on each of the other two. The looms of one line are separately belt driven from a common belt shaft which is served by a driving unit complete with the motor, V-belt first reduction and chain second reduction. The small centres of this compact driving unit have permitted the final drive to be taken from the original line-shaft. The motors are mounted on cross girders near the roof. A 3-HP motor drives six looms; a 6-HP motor also drives six looms, but *via* a heavier shaft to permit extensions; and a 7-HP motor drives eight looms. These motors are direct-on-line started by push-button units.

About 56 looms in another room and 50 looms in a room immediately above this one are all driven from four motors in the lower room. A 25-HP, 1,000 RPM motor drives each of four line-shafts, and each line shaft serves two lines of looms—one up and one down—with about 32 looms

on each shaft. In each drive there is a V-pulley and flat face reduction by chain and sprocket, giving a line-shaft speed of about 88 RPM. The motors are controlled by Ellison oil-immersed starters.

After examination and mending cloth from the looms is passed through scourers, four pieces in rope form at one time per machine, in the alkaline solution in which the oil put into the material in the rag stage is extracted. Then, in a wringer, the liquid is squeezed out, after which comes milling or fulling, which involves passing the cloth through an earthenware spout under pressure and in a soap solution. This softens and thickens the cloth and shrinks it to the required width.





Tentering involves drying the cloth as it passes through a steam-heated chamber while held taut. For meedling (inset) there are on the front of the tentering machine two sensitive ¼-HP motor-driven units

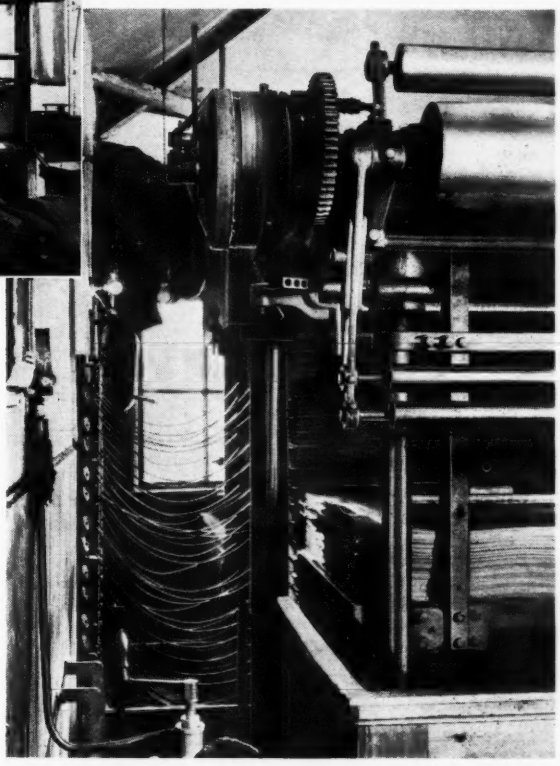
Five scourers have a group drive *via* a line shaft from a 30-HP motor with a speed reduction from 1,000 RPM to 100 RPM at the shaft. Twelve milling machines are driven by a 60-HP, 1,000-RPM motor unit complete with a Croft reduction equipment which gives a 9 to 1 reduction at the shaft to which the gear is directly coupled. In another case four milling machines are driven from a 25-HP motor with V-rope and chain reduction drive from 1,000 to 110 RPM.

Finally, in the scouring house, the cloth is taken through an open-width washing machine in which the soap in the cloth is removed, leaving the material ready for dyeing. The rubber rollers of the washer, and the cutting frame on which the cloth is lapped for handling, are driven by a 2-HP motor. A 10-HP 1,500-RPM motor drives a pump in the washer vessel which forces water through the cloth while this is travelling flat over the spray.

Dyeing is usually a two-fold process, first for the wool content by a boiling process and then for the cotton content by a cold process. Five dye pans for the boiling work are each driven by a 2-HP motor unit complete with a Croft reducing box mounted on the machine side. The reduction gear is flexibly coupled to the winch in the vessel and the overall speed reduction is from 1,500 RPM at the motor to 60 RPM at the winch. The motor is reversible with simple change-over switching and direct-on-line starting. Ten washers for the cotton staining are arranged on two line-shafts, each served by a 15-HP motor. An unusually large reduction for V-belt is from 750 RPM at the motor to 110 RPM at the shaft. Further reduction to 80 RPM at the washer is by flat belt.

Tentering, the next operation, involves drying the cloth as it passes through a steam-heated chamber while it is held taut at the required width by the teeth of two endless conveyors, one at each side of the piece. The conveyor system is driven by a 2-HP constant speed (1,000 RPM) motor directly coupled to a variable-speed gearbox with a chain drive to the machine. On the infinitely variable-speed principle, with a V-pulley in two sections whose distance apart can be varied at will, the gearbox imparts a cloth speed variable from 4 to 15 yds. per minute. Steam is blown into the heating chamber by two directly coupled 2-HP motor fans, and there is a 10-HP motor-driven suction pump which removes excess water from the piece.

For meedling, *i.e.*, putting the cloth on the conveyor pins and keeping it in the required position, there are on the inclined feeding table at the front of the machine, two ¼-HP motor-driven units. Each of these operates through a sensitive device with fast and loose pulleys on to the edge of the cloth and drives a rubber caterpillar which straightens the edges ready for registering them on the pins.



Each tenth press paper on the cloth press constitutes a 20-V heater ; series wiring for the heater banks is arranged at the plug board

Finishing operations include cropping the surface of the cloth on a machine which operates on the principle of the lawn mower, except that the revolving cutter remains at one position while the cloth passes over the knives; brushing the surface of the cloth by passing it over the revolving brush of the brushing mill; removing creases in an oil-pressure operated and electrically heated press; removing the shine received in the press on the brushing mill on which the cloth is passed over a steam box; measuring on a cuttler and folding into half width on a folding machine.

(*Concluded at foot of next page.*)

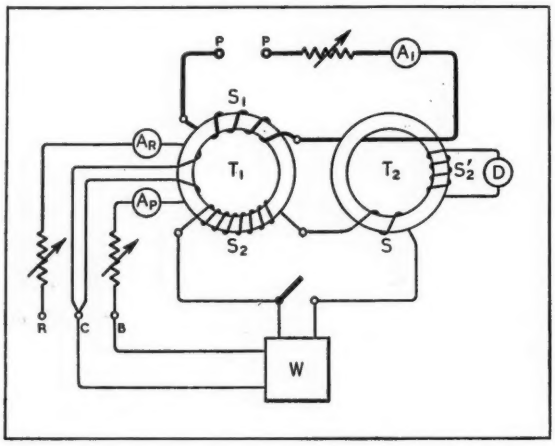
CURRENT-TRANSFORMER ERRORS

Their Determination by Self-compensation

By G. F. Freeman, M.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.

IN using Class A* current transformers with sub-standard wattmeters it is desirable to know their errors within about ±0.2 per cent. If standards of suitable ratio are available it is relatively easy to determine these errors by comparison, but in their absence it is worth while considering methods which require no apparatus beyond what is available in a modestly equipped laboratory or test room.

A. Glynne† has recently shown how the errors of an equal-ratio Class AL* transformer may be found to a high degree of precision by a differential method, the general process being to compensate for ratio and phase angle separately from an auxiliary two-phase supply, using an appropriate null detector. Similar compensation may be applied in cases of unequal ratio,



Transformer test circuit

but a direct detector cannot then be used. The addition of a "mixer" to take account of the alteration in ratio, however, permits a differential balance to be effected. I have used this in the form of a second Class A transformer which happens to be available, adapting it by the temporary addition of a few turns of lighting flex over the outer casing; any small ring core would, however, serve the purpose, provided it were made of high-permeability nickel-iron or equivalent material.

In the accompanying diagram, T_1 is the transformer under test, fed from the terminals *PP* of a phase shifter; S_1 and S_2 are the primary and secondary windings respectively. T_2 is the mixer; its secondary S'_2 is connected to the detector. The main circuit is linked once and the secondary S times with the mixer core, S being the nominal ratio of T_1. It is clear that if T_1 is perfect (or appropriately compensated) the opposing ampere turns on the mixer core will exactly balance, and there will thus be no flux to actuate the detector. Single-turn windings fed from phases *RC* and *BC* of a two-phase supply provide compensation for ratio and phase errors respectively. The percentage ratio error at balance is $100\ I_R/S_1I_1$, and the phase error $\sin^{-1}(I_P/S_1I_1)$, I_1 and I_R being in phase coincidence. Currents are measured by first-grade ammeters.

The current coil of the wattmeter *W* with which T_1 is normally used is a convenient burden, augmented if desired to a standard amount. If the volt circuit is connected to the quadrature phase *BC*, the phase shifter is adjusted until the wattmeter reads zero. A switch across the burden enables the short-circuit errors to be checked and the sign of the ratio errors to be determined; the phase errors (in the absence of capacitance) are, of course, leading.

Certain precautions must be taken to obtain accurate results. The rheostats used in the compensating circuits should be reasonably non-inductive; those wound on iron tubes have appreciable (and variable) phase angles. The quadrature of the two-phase supply should be checked, e.g., by a wattmeter method, bearing this in mind. (Note that if the phase compensation of a 30-min. error is 5 deg. phase shifted it will affect the apparent ratio error by about 0.1 per cent.)

It might be thought that compensation should be applied to the mixer rather than the main core, since the transformer is then working in its normal way. Tests indicate, however, that within the limits of Class A errors this is quite immaterial, and it is more convenient to compensate on the main core, as this allows larger currents to be used, an advantage in measurement when the errors are so small.

In testing a "miniature precision" transformer with a full load MMF of 200 ampere turns it was found that 10 ampere turns at full load on the mixer gave sufficient sensitivity down to 1/20 load when used in conjunction with a 400-turn detector coil, a cheap self-contained moving-magnet vibration galvanometer of 6,000 ohms resistance giving a deflection of 1 mm. at 20 cm. for 10 microamperes, and a small amplifier. The latter, built of odds and ends, was battery driven to avoid strays, and increased the sensitivity some 20 times for a h.t. consumption of 2 mA at 60 V.

It may be remarked that, having thus found the errors of one transformer, others may be checked from it by a comparison method, e.g., Glynne's adaptation of Nolke's method. For this purpose, the vibration galvanometer without amplifier is an amply sensitive detector.

Obtaining Two-phase Supply

The methods described have been found serviceable in the Electrical Engineering Department of the Municipal College at West Ham, where the supply provided by the local authority is, conveniently, two-phase. It is, however, no great matter, since the compensating circuits are of low power, to arrange a two-phase supply from an ordinary three-phase system. Multi-turn compensating windings may if desired be used to suit low-current ammeters (e.g., voltmeters), while there is no objection to using more ampere turns on the mixer to gain sensitivity (directly proportional to the ampere turns) provided that the additional burden is not too great, and is taken into account if significant. Only the resistance of the winding *S* need be considered, since the inductance is wiped out at balance, and in the case cited this amounted to some 3 per cent. of the wattmeter burden.

It is possible to omit the phase shifter and take the main supply from the phase R_c. This, however, is apt to upset the phase angles due to unbalanced loading and rheostat inductance, so that if a small wound-rotor induction motor is available for use as a phase shifter it is to be preferred. Heavier primary currents are obtained conveniently from reversed current transformers, and the loading may alternatively be measured by an ammeter on the secondary side, making allowance for the consequent burden.

With due attention to these details, an accuracy of ±0.25 per cent., approaching ±0.1 per cent. in favourable conditions (both errors small, load current near full value) is to be expected. The precision of measurement is better than this, but temperature effects on commercial transformers make it unwise to depend on closer limits, for which purpose Class AL or AM transformers should be used.

* See B.S.S. 81 (1936). † *Electrician* 17.3.39 (p. 341).

Textile Mill Conversion (*Concluded from preceding page*)

There is one group drive by a 12-HP motor for all the machines in the finishing room, except the press. This has a small motor for raising or lowering the two loading platforms, a ½-HP reversible motor for cloth loading and unloading, and a 6-HP motor which drives the oil pump for the operation of the ram. The press accommodates 1,200 yds. of cloth which is submitted to 2 tons per sq. in. for five hours.

Lapped to and fro in the press, the cloth layers are interleaved with press paper and every tenth paper constitutes a heater, with 20-V elements embedded in it. The heating papers are arranged in banks of five in series, supplied at 100 V, single phase. Other finishing operations include raising the surface of the cloth for blankets and dressing-gowns.

We are indebted to Mr. Richard Bradley, partner, and to Mr. A. Buckley, maintenance engineer, for their help in the collection of the above information.

ELECTRIC THERMAL STORAGE

A Means of Coal Conservation in the National Interest

By W. L. Shand, M.I.E.E.

THE effect of the proposal to ration electricity supplied to domestic consumers at 75 per cent. of their normal requirements was intended to compel economy in its use for all purposes. This allowance has since been increased to 100 per cent. on the somewhat curious ground that the amount used had already been very much reduced by the lighting restrictions! But if the result is that more instead of less electricity is consumed for cooking and heating a considerable economy in fuel will be achieved.

Apart from cooking—and, of course, lighting—water-heating and space-warming account for the greater part of the energy consumed in an all-electric house. Water-heating already employs the thermal storage principle, and so does electric space heating in large buildings equipped with central heating systems using electric boilers. There is also the thermal storage cooker which will be referred to later. Hitherto, however, the thermal storage system has been regarded almost exclusively as a means of reducing the fixed charges by keeping down the maximum demand, and since this represents an economy on capital account it is more important than ever in the present national emergency, but the system can also make a very substantial contribution to fuel economy by ensuring that more and more coal is burned efficiency in large generating stations instead of inefficiently in small grates, bringing about considerable enonomy of transport.

Water and Space Heating

Electric water heating has already become very popular not only because it is clean, convenient, flexible and ever-ready, but because it is cheap in comparison with other systems, in spite of the fact that supplies are not restricted to the off-peak periods, though the combination of thermal storage and thermostatic control does improve the load factor to the advantage of the supply authority, while the elimination of long lines of piping reduces radiation losses to the minimum. Many an electric domestic hot water proposal is turned down, however, because a coke-fired central heating system is being installed in any case and it may just as well supply the hot water for washing purposes also. In other words, progress in electric water heating is retarded by the absence of an equally cheap and convenient system of electric space heating.

For space heating on the thermal storage principle, in by far the majority of cases the hot water radiator system is used with central boiler and storage tanks, the only difference being that the water is heated by electricity instead of by other means. It must be admitted at once that, except on a comparatively small scale, electric fires, convectors and tubular heaters which take electricity from the mains at all times irrespective of the incidence of maximum demand, usually make electricity more expensive to supply than solid fuel and, at any rate, bring it into close competition with gas and oil. Where, however, the thermal storage principle is used and the fixed kW charge eliminated from the cost of energy, the efficiency of the electric boiler and the savings in construction and maintenance costs are such that the cleaner and more convenient electric system becomes an economic proposition as is evidenced by the fact that in this country over 300,000 kW of thermal storage space heating is in use.

Now, one of the chief arguments in favour of using electricity from the mains for all possible purposes, *i.e.*, light, heat and power, is because the primary source of energy is coal, a home product, and because in the large power stations which supply the grid the cheapest quality can be transported and burned with a high degree of efficiency. Whereas the present price of coal for domestic purposes is not less than 35s. a ton, that used in power stations averages 23s. a ton. It is for this reason that the principle of thermal storage, hitherto regarded chiefly as a means of restricting demand on the peak promises can, in this national emergency, be an important contribution to fuel and transport economy.

Thus the position may be stated as follows:—

(1) Electricity for cooking and water heating has so many direct and indirect advantages that at the prices generally ruling it is economical even without thermal storage.

(2) Electricity for space heating, if used direct and bearing its share of fixed charges, is rather a luxury.

(3) Electricity for space heating when the thermal storage principle is incorporated is not only economical to the consumer, but results in a direct saving of high-grade coal.

The central heating system, with electrode or resistance water heater and large thermal-storage tanks, is already extensively used in large new buildings, but it is scarcely applicable to old buildings or to houses of moderate or small size. Incidentally, the use of the central heating system as a medium for heating by electricity seems to constitute a degradation of an extremely refined source of heat. Turning the heat in coal into electrical energy delivered to the consumer involves throwing away nearly 70 per cent. of the original heat units, but it produces energy in a form which can be used for the production of heat exactly where it is wanted and with an efficiency of 100 per cent. Surely to debase this highly refined source of heat to the level of crude coal or coke by turning its heat units back into hot water for distribution by means of costly, cumbersome and wasteful hot water pipes is a confession of failure to take full advantage of electricity's unique properties.

In certain hydro-electric countries, such as Switzerland, Norway, Canada, &c., an alternative to hot water storage has been developed. The heat accumulator consists of resistances formed of columns of crushed ores, such as magnetite, enclosed within walls of a refractory material and taking their electrical input at night from the high-voltage mains. These columns are placed on grates over air ducts so that the stored heat may be drawn out by fans, and the hot air, after conditioning, delivered by pipes or ducts throughout the building to be warmed. The temperature worked at reaches 500 deg. C. and the thermal efficiency is stated to be over 95 per cent, though if this includes radiation losses in the heater itself it suggests almost perfect heat insulation which is very hard to obtain at such high temperatures. Even this system, however, requires long lengths of large pipes and ducts.

What is needed to enlarge the field for electric space heating is the development of a small self-contained thermal-storage heater, for if such an appliance were available at a reasonable price and in large quantities, small detached dwellings could enjoy the same advantages and economies of "general heating" as the big blocks of flats and offices do.

What is Available?

If, as is contended, an extension of electric heating would result in substantial economies in the use of our native fuel and so release the best and highest priced for export, I suggest that the Government should offer some direct encouragement to the Central Electricity Board, the authorised distributors, and electrical manufacturers to develop electrical thermal storage and to produce the necessary appliances on the lines indicated above. This would afford a great opportunity to the sales departments of progressive undertakings to intensify their efforts to increase their heating and cooking loads without increasing fixed charges.

How much off-peak space-heating business could be done if suitable thermal-storage appliances were available and the price per kWh were low enough? According to the 1937-38 returns of the Electricity Commissioners there were over 9 million consumers. Of these 7¼ millions were domestic, with a consumption of 4,291 million kWh per annum, or 572 kWh per domestic consumer. It has been estimated that the average distribution demand is 1 kW per 1,000 kWh consumed per annum for domestic load. This means a load factor of 11.4 per cent., so that there is plenty of room for improvement. Many quite small houses which have electricity for lighting, cooking, water heating and occasional fires use 5,000 kWh per annum and would use 10,000 or 15,000 more if the equivalent of central heating could be provided at an economic price.

Another way of looking at this question is from the point of view of the total generating capacity in the country available for supplying off-peak load. Connected to the "grid" there is over 9 million kW of generating plant with a corresponding maximum demand of 6,700,400 kW. Energy sold for the same period was 24,376 million kWh. This gives a load factor of 42 per cent. Assuming that this could be increased to 70 per cent. without interfering with maintenance procedure, an additional 17,000 million kWh per annum would be available without increasing the maximum demand.

Now, in calculating space heating it is customary to assume a demand of 1 W for every kWh consumed per annum. If, therefore, for the sake of argument, half this, *i.e.*, 4,250,000,000 kWh, were devoted to off-peak space heating, one arrives at an aggregate heater capacity of 8½ million kW. Such a load is, of course, beyond the existing generating plant

capacity but it does at least give some idea of the magnitude of the possible demand for electric-storage heaters. And it is not so fantastic as it looks for even 8½ million kW divided among 7½ million domestic consumers is only 1¼ kW per consumer. However, the maximum off-peak supply available is only of the order of 7 million kW and if, as before, one allocates only half of it to space heating there is a figure of only ½ kW per consumer. There is thus enormous scope before the saturation point is reached.

Reverting to the subject of small localised electric thermal storage heaters, each connected separately to a time-switch controlled heating circuit, this was discussed at some length in the ELECTRICAL REVIEW of April 9th, 1937. In spite, however, of the vast potential demand for such appliances, if they can be kept within reasonable dimensions and sold at a moderate price, little progress seems to have been made since that article was written. In this country, so far as I am aware, the only small electric thermal storage space heater in which water is the storage medium takes the form of a hot water radiator with a heating element in it. There are several makes which are efficient and effective, but while water is an ideal heat storage medium, the fact that it boils at 212 deg. F. means that, in practice, it may not be heated beyond, say, 180 deg. in an ordinary radiator. This in turn limits the quantity of heat that can be stored in a given mass of water and, in consequence of this limitation, some other kind of storage mass must be found for peak periods of 3-4 hours.

Types of heater using soapstone, cast iron and blocks made of ground up stone or marble have achieved some success, mainly abroad, though the Soapstone Products Co., which imports its material from Sweden, has a number of installations in this country. Soapstone is a natural quarried stone, easily worked into the required shapes on account of its softness, and capable of storing a fairly large quantity of heat per unit of bulk, and afterwards releasing it slowly into the space to be warmed. The heating elements are let into the stone and are usually connected to a time-switch controlled circuit so that they are switched off at the peaks. A drawback so far as this country is concerned is that the soapstone has to be imported and freight is a heavy item of cost. With regard to control of the heat emission, most of the standard models rely solely on the properties of the soapstone itself, though some of the larger heaters are provided with a case with doors or adjustable louvres. The absence of thermostatic control may, however, in certain circumstances result in waste.

Als-Thom, of Paris, make a heat accumulator that consists of a block of cast iron, heated by electric elements suitably placed, and pierced by internal passages of large radiating surface through which air is drawn by means of an exhauster fan. The storage block is enclosed in a heat-insulated casing of decorative external appearance and heat emission is controlled by a room thermostat which operates the fan. Thus when the room has reached the required temperature the fan is switched off. Control of electricity input is usually left to the time-switch supplemented by an ordinary hand-operated switch. To avoid overheating the block and burning out the elements the amount of heat insulation provided by the casing must be so limited that when the maximum permissible block temperature is reached any further heat generated will be "spilled over" into the room. This is wasteful, but provision can be made for thermostatic control though unfortunately this adds very considerably to the cost of the appliance.

Another thermal storage space heater is made by Le Chauffage Electrique, of Paris, whose storage medium is called "basaltine," which appears to be ground up basalt formed into slabs of the required size and shape. Electric heating elements are sandwiched between these slabs and the block so made is enclosed in a heat insulated case. Cold air is admitted at floor level and is carried by convection over the heated block, which works at a temperature of about 500 deg. C. Heat input is not thermostatically controlled locally, but in the case of large installations thermostats external to the building are interposed in the time-switch controlled circuit so that a rise of external temperature cuts off the electricity irrespective of the time switch. This arrangement probably results in a certain saving, but as there is no automatic control of the temperature of the storage block itself the same wasteful "spill-over" already described has to be allowed for. Heat emission is by means of a vent provided with a shutter or valve worked by hand.

It will be appreciated that none of these heaters quite fills the bill, and a new type is being evolved which, though not yet on the market, has shown results obtained from the first experimental model sufficiently promising to warrant the construction of a number of 2-3 kW models which, if they prove satisfactory, can immediately be put into production on a commercial scale. The principal features are:—(1) Automatic thermostatic control is provided to cut off the supply to the storage block heating elements at a prearranged temperature. Thus the only limit to the amount of heat insulation, and therefore to the efficiency as a heat accumulator and retainer, is the permissible size and weight of the heat insulating material, since there is no longer any need to allow heat to leak out for reasons of safety. (2) Again, owing to this automatic input control, it is possible to run the storage block at a high temperature, thus enabling a large number of B.Th.U.'s to be stored in a comparatively small block, so extending the period available for avoiding the peaks. (3) On account of these features the heater can be manufactured comparatively cheaply so that the difference in cost between a storage heater and an ordinary convector, or tubular heater of equal capacity is very much more than covered by the annual saving in fixed charges resulting from its being kept off the peak.

The Cooking Aspect

With regard to the application of the thermal storage principle to electric cookers, the General Electric Co., Ltd., has had two types on the market for some years in which a cast iron block is the storage medium. The first of these was designed for a continuous supply all the year round at 500 W delivered to the storage block, the upper surface of which formed the boiling plate and the lower surface radiated top heat into the oven below, when required. The oven is also provided with 500 W of heating elements and when it is in use the 500 W load is transferred from the storage block to the oven elements while, by shutting down the heat insulated cover of the boiling-plate the residual heat in the storage block is directed downwards to the oven which thus, at the start at any rate, receives the heat equivalent of 1,000 W. This 500 W model has proved useful for small households in isolated situations, but suffers from its low rating and consequent inability to respond to an emergency.

The other model is of the semi-storage type, that is to say, while the boiling-plates are worked on the storage principle, the oven is connected direct to the mains, as and when it is required. In this model the overall load limit is 1,950 W. The storage-block boiling-plate is supplied at 125, 250 and 500 W, but the oven can nevertheless receive the whole 1,950 W as the rotary multi-heat control switch automatically disconnects the storage block while the oven is required to be full on. This model has a wider field than the other, but it is a compromise and not as handy for the user as a standard cooker.

In Switzerland the "Pilum" storage cooker has recently been put on the market. It has certain interesting features, the chief of which is that it employs distilled water as a storage medium, enclosed in a steel container and raised to temperatures of up to 550 deg. C. The advantage of water is, of course, its high specific heat; the disadvantage is that the very high pressure which corresponds to such a high temperature requires that the container shall be of enormous strength. This difficulty has, presumably, been overcome since the cooker has been passed as safe for domestic use. The heat from the storage mass is conveyed to the oven, boiling-plates and a boiler supplying domestic hot water, by conduction through cast iron stalks or rods of such sectional area as to maintain the appropriate temperature at the point of use in each case. It is claimed by its makers that while the cost of the "Pilum" storage cooker with oven, two boiling-plates and boiler is not more than that of a standard form of cooker-boiler of like capacity, and the maximum loading is only 700-800 W, the cost of operation on the special tariff obtaining is only half that of a standard cooker.

Conclusions

It is apparent, I think, from the foregoing that:—

(1) The use of electricity for all forms of domestic heating, except in the case of buildings large enough to have really efficient boiler plant capable of burning low grade coal, contributes substantially to fuel economy.

(2) To make electricity available for general space heating at an economic price it is essential that the cost either to the electricity distributing undertaking or to the consumer should not have to bear more than a small proportion, if any, of the fixed charges on generation and distribution.

(3) Thermal storage affords the only means of achieving these results.

It is clear that in a matter of this kind it is necessary for the electricity supply authorities, including the Central Electricity Board, to take the lead by quoting special terms to consumers not only for electricity but also for the storage appliances required, and I feel that the time is ripe for an immediate drive by supply undertakings and manufacturers alike, especially in view of the recognition by the Government that the use of electricity in place of crude fuels is in the national interest.

ADEQUATE WIRING AND REWIRING

Some American Proposals Reviewed

By H. R. Taunton, A.M.I.E.E.

WHEN the world and I were young together, and electric lighting was still a novelty, a vast field of installation enterprise was open to the few then equipped to enter it. The palaces and monuments of history, the big factories and offices of the industrial age, the thousands of country houses, the mansions, the emporiums, the theatres and halls and institutes of the cities, all the great buildings of the country in the world richest in them were clamouring for the new illuminant. A golden age, and, alas! long past. To-day, there are a hundred times as many electrical contractors, and the few plums left to them to scramble for are practically all new buildings. The electrical wiring industry is now essentially bound up with the building industry. They flourish and stagnate together.

What has become of those installations of thirty, forty, fifty years ago? Probably most of the older ones, those carried out in casing and compo, or with surface systems, have been renewed from sheer necessity or because renewal has been as easy as it was desirable. But the case is different when we come to those installed on so-called "permanent" systems: gas-barrel (as so much of the best work was in the old days) or heavy-gauge conduit. Such "ironclad" systems are only permanent in the sense that the barrel or conduit, properly installed, is likely to last as long as the buildings in which they are run, if modern, or—shall we say?—until internal wiring is superseded by some new invention if the buildings are the time-defying works of our forefathers.

Difficulty of Renewal

The most substantial wiring installations are impermanent in their switchgear, fittings and accessories, which become worn, damaged or out of date. Their renewal, however, is obvious and generally easy. What is not so easily renewed is the actual wiring. The insulation of the wires and cables enclosed in permanent conduit is far from permanent itself. Light, current-heating effects, condensation, chemical disintegration, all affect it and make its life a variable unknown which often proves to be a relatively short one.

Thirdly, and most important, the best designed installation loses its claim to permanency just as quickly as it loses its initial adequacy. With every day its user wants more light and heat, and finds more and more uses for electricity. Rapidly it becomes inadequate in outlets, inadequate in copper. It is here that the "permanent" conduit system is at a disadvantage with the lighter surface wiring systems. Extension to new outlets and the replacement of overloaded mains and sub-mains by larger ones is comparatively easy and inexpensive with a flexible, surface system, such as "cab-tyre." In conduit, on the other hand, the running of extra circuits or the increasing of sub-mains nearly always means installing a larger size of tubing. Consultants and careful contractors may optimistically plan the original lay-out to allow for reasonable future additions. In practice, however, their ideas are usually stultified by practical considerations met with in the course of the work, to say nothing of the exigencies of competitive economy; and in any case, what they may think reasonable future additions invariably fall short of what is presently demanded by the swift advance of electrical conveniencies.

The trouble with these ironclad installations is that their users, very naturally, cannot be persuaded to the heavy expense and disorganisation of altering the conduit, since it entails cutting up the walls and floors, and a consequent outlay on redecoration. So they make shift dangerously with flex extensions and overloaded circuits, or else must be starved of all the possibilities which electricity offers them. Since practically all the large and important installations in the country—certainly within the last twenty or thirty years—have been carried out in conduit, more or less concealed, we are accumulating with every year a mass of obsolescent internal wiring which cannot be adapted to present-day needs because its owners cannot afford, not the cost of the extra copper necessary, but the much larger cost of all the paint and plaster and woodwork which would have to be scrapped and replaced. Cut out that latter deterrent, and the other would have little weight with users anxious for the amenities of a larger electrical installation.

In short, a vast field of enterprise in the rewiring of outdated installations, with opportunities of profit probably equal to what could be expected from several years of new building work, is open to contractors if they can find the key to it, and use it with energy. The crucial problem is to increase the copper in an installation without disturbing the buried conduit.

One solution to it is outlined in a booklet which the Editors of the ELECTRICAL REVIEW have given me the opportunity of reading. It is called a "Discussion of the Revision of the National Electrical Code proposed by the Electric Light and Power Group," and is issued by the Edison Electric Institute of New York. The three smaller booklets mentioned in a notice in the issue of the ELECTRICAL REVIEW of October 13th are complementary to it. They are "Basic Factors of Adequate Wiring," "Covered Neutral Cable helps sell Adequate Home Wiring," and "Commercial and Industrial Building Rewiring Market." Each deals separately with one of the main points of what we may call, for brevity, the "Discussion." They are well-produced and illustrated publications of the "sales propaganda" type; and as their contents have already been summarised in the notice mentioned they need not here concern us.

The "Discussion" is much more important. It contains 123 quarto pages of electrical data and argument, with numerous tables and graphs, many of which will be novel to contractors. It has all the substantial matter of the three booklets, but is more of a serious technical treatise. It is particularly addressed to American contractors, but in so far as the problem with which it deals is common, it is of equal interest to us here. Every contractor who would like to have the run of an hitherto almost unexplored field of development—and I suppose that goes for all of us—should get a copy, by hook or by crook. He will certainly learn something from it.

Here it is only possible to indicate briefly its contents. Ostensibly, it is a detailed argument put forward by an interested party—the "Electric Light and Power Group"—for the alteration of certain rules of the National Electrical Code, which is due for revision this month. (Incidentally, here is a sidelight on a difference between methods. In America, it seems, proposed alterations to their Wiring Code are given wide publicity months beforehand, so that they can be discussed by any interested in them. In England, apart from a small inner circle, the general mass of the industry can only criticise our Wiring Code after it is published, when it is too late to do anything but accept it as it stands.)

Suggested Code Amendments

To return. The rules it is desired to amend are those which at present bar the full use of certain methods deemed necessary for the adequate rewiring of existing conduit installations, or, more broadly, for the adequate wiring of any buildings. Actually, then, the booklet is a full discussion of those methods, of their need and their advantages.

It is based on two articles by Mr. C. W. Kellogg, "What is Needed to Promote Adequate Wiring," which originally appeared in the *Electrical World*, and are reprinted in the booklet. In them he outlines the problem, much as I have paraphrased it above, and puts forward eight proposals to solve it. To quote the introduction: "... they are calculated and intended to produce more work on wiring jobs in the rewiring field and therefore are independent of general activity in the building industry. Technically, the proposals are directed towards more copper, more circuits and more outlets, that is, towards actual technical adequacy for interior wiring installations." The "Discussion" deals with each of these proposals in detail. The more important of them are as follows:—

The use of a bare neutral in conduit, on AC supplies only. This is supported by arguments based on recorded experience and experiments tending to show that "by-pass" currents, under the conditions stated, are negligible; and a number of tables and graphs are given in illustration. The use of thin-wall insulation. "Superior rubber compounds and synthetic insulations have appeared ... considerable work has been done towards reducing the braid, which is the most bulky component of conventional building wire." Cables of smaller sectional area for equal copper, allowing more of them to be drawn into a specified size of conduit, would more effectively occupy its net available cross-section. In connection with this, an appendix gives some interesting data on tests made to determine the number of cables which, in practice, can be drawn in or out of various sizes of conduit. A third proposal, and the last we need mention here, is the use of con-

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Trolley-bus Supply

THE article by Mr. T. Kearns in your issue of December 1st suggesting that the three-wire system should be used for the trolley-bus is of great importance and, fortunately, with a little alteration in the plan, it can be put into operation without difficulty. His diagram supposes that the two sides of the three-wire system would be used alongside each other, but this produces difficulties at cross-overs and it also transgresses the rule that 1,200 V shall not be used on the overhead lines.

These difficulties may be overcome by dividing the overhead line into sections of a mile or two each, alternately positive and negative, in much the same way as one house is balanced against another on a distribution network. In relatively small systems this might be sufficient, but further sections might be added with large systems. The neutral line runs through and the currents in it are balanced so that the total current is small.

The change from a positive overhead line to a negative would be arranged on an easy position so that the bus could run through the break without difficulty. So far as running is concerned the line would work as a two-wire system and the present cross-overs would be unchanged. The feeder currents would be reduced to about half their present values and the neutral currents would be even more reduced, and there seems to be no reason why the method might not be put into operation forthwith. It might even be possible to use it on other forms of electric traction, but there other problems arise. C. TURNBULL.

Tynemouth, *December 9th.*

Wholesalers and the Public

In the course of a long experience I have often run into the problem of trade discounts being allowed to outsiders. I have also noticed with mixed feelings the full list prices being charged to the people in like category. I am, of course, referring to wholesale houses. May I therefore make a suggestion? Let us first recognise that the public have, generally speaking, the right to make purchases where, in their judgment, the best service is available. Many of them, rightly or wrongly, choose to go to the wholesalers where, in my own experience, they are served.

Here, then, is a way to deal with the problem that I think will meet with approval. Let the wholesaler serve the public if the public desire it, at full list prices. The bill should be made out on a specially coloured paper and the difference between the trade prices and the list prices credited to a separate fund. The fund so accumulated should be distributed between the Electrical Industries Benevolent Association and the benevolent fund of the Electrical Trades Union, annually.

London, E.3, *December 9th.* WM. G. BROWN.

Control at Luton

I have read the editorial paragraph with this heading in the current issue of the ELECTRICAL REVIEW, and cannot help feeling that it is somewhat unhappily worded and is not quite a true interpretation of the position. I shall, therefore, be glad if you could make a revised announcement in the coming issue, so as to correct any misunderstanding which may have arisen.

It was agreed at the time of my appointment that the general organisation of the undertaking should be reviewed within twelve months and the matter was dealt with by the Electricity Committee and the Council at their November meetings as announced in your last week's issue. Up to this time, it had been the practice for the showroom manager to regularly attend the monthly meetings of the Electricity Committee and be jointly responsible to the Committee and myself for the control of the showrooms and sales activities. Now that I have been appointed general manager of the complete undertaking, I am solely and directly responsible to the Electricity Committee for all showroom and sales activities.

In conclusion might I add that since taking up my appointment here, both the members of the Council and my fellow officials have been most friendly and helpful, and I do particularly appreciate the splendid support which the chairman of the Electricity Committee has at all times given me.

Luton, *December 11th.* RENNIE DEAN.
General Manager and Chief Engineer.

Adequate Wiring and Rewiring (*Concluded from preceding page*)

centric (single- or twin-core) cables with a lightly insulated, braided, outer, stranded to form a metallic sheath. This, and the arguments in support of it, is not entirely new to us here. It is advocated for surface extensions.

The general conclusion of the "Discussion" is that the adoption of these three proposals, and other minor ones, for additional circuits, or to replace present overloaded circuits, would increase the amount of copper in existing conduits to an extent which would satisfy, at a relatively small cost, all the normal requirements, now and for a reasonable future, of users of installations which at present are inadequate in outlets, circuits and current-carrying capacity.

All this, as is pointed out, is to the advantage—apart from the users—of supply companies, manufacturers and contractors prepared to exploit the new possibilities opened to them by these proposals.

The "Magnetic" Mine

Your leaderette on the above subject in your issue of December 1st grossly underestimates the difficulty of operating a mechanism by the force or couple between a magnet and the iron of a ship. The inverse square law applies to the field produced by an imaginary point pole, but any real magnet has two poles of opposite sign which largely cancel one another's field at any considerable distance.

Beyond, say, five times the distance between the poles, their joint field varies very nearly as the inverse cube of the distance, and this law would apply to the *couple* exerted on a second permanent magnet. But if the iron has to be magnetised by the field of the magnet, the induced magnetism will be roughly proportional to that field, giving the inverse sixth power for the couple.

The case is even worse for the *force* between two magnets, for that depends upon the *difference* of the fields caused by the first magnet at the two ends of the second one; this difference varies as the inverse fourth power. Thus the force between two permanent magnets varies as the inverse fourth power, and that between the permanent magnet and a piece of iron as the inverse seventh power when the distances are not small.

Now, try to construct a relay to be operated by these extremely small forces, or couples, which will not be affected by the earth's field (which is much greater than the one which you are trying to use), and which shall be so well balanced mechanically that it will not be operated by the inertia forces caused by every movement of the mine which carries it. DAVID ROBERTSON.

Bristol, *December 8th.*

Dialling Extension Numbers

In your December 8th issue, under the above heading, there appears a reference to an invention by two Russian scientists. In the absence of any details, we do not know what the invention actually covers, but so far as we can judge, the idea is by no means a new one. For some considerable time past, we have designed private automatic branch exchanges which will allow a caller to connect himself to any extension by dialling.

The reason why this facility has not been universally adopted is that it has little practical value. In the first place, it necessitates the possession by the caller of a directory showing not only the numbers relating to the exchange lines, but also those of all extensions. Secondly, in commercial and private life, it is generally undesirable that anyone shall be able to get through to an executive, department or room without warning. Furthermore, control of calls becomes difficult and the time taken for completing a call is longer than when this facility is not provided.

With regard to small automatic exchanges, we are at present marketing a 10-line P.A.X., the overall dimensions of which are only 28 in.×5½ in.×6½ in. and which weighs only 37 lb. It is portable and can be installed in a few hours. We thought you would wish to have these details to correct the impression which your readers might form that we lag behind in this country in technical development.

London, W.C.2, *December 8th.* RELIANCE TELEPHONE CO., LTD.,
E. SILBERMAN,
Managing Director.

INSTITUTION PROCEEDINGS

Four I.E.E. Papers for Discussion

Loudspeaker Design

THE design of a radio loudspeaker for living rooms is outlined in an I.E.E. (Wireless Section) paper by Messrs. W. West and D. McMillan (Post Office Engineering Department). The particular design dealt with has resulted from P.O. experimental investigations. Is it the type of instrument likely to be used for P.O. radio relay services, when instituted?

The authors' essential requirements are that the speaker shall be capable of standardisation for inexpensive production in quantity, and that the quality of reproduction shall be superior to that of generally available commercial instruments. A specification has been issued to interested contractors and tenders for the manufacture of such instruments invited. Some of the resulting samples have been satisfactory, both as to performance and price; but there is not yet any experience of the mass-produced article, or of methods of acceptance testing of supplies in bulk.

The authors consider that as a criterion of faithfulness of reproduction, comparison of a variety of types of sound reproduced by the loudspeaker with the original sources, heard in the same room, cannot be improved upon. The room should be of a kind similar to that for which the use of the loudspeaker is intended, and the types of sound should be restricted to those which might ordinarily be heard, as original sources, in such rooms. In any such comparison the influence of the acoustics of the microphone studio should be negligible.

For loudspeakers to be used in living rooms, this criterion appears to be satisfactorily met when the total power radiated by the loudspeaker in free space is independent of the frequency. This requirement is, at low frequencies, fulfilled to a close approximation by a moving-coil loudspeaker of the usual type when it is mounted in a closed and adequately soundproof case, so that the main resonance of the diaphragm lies near the lowest frequency which the loudspeaker is required to transmit at full efficiency, and when this resonance is sufficiently damped, e.g., by a covering of felt closely surrounding the back of the diaphragm.

The requirement of uniform power radiated can be simplified, for a loudspeaker of this kind with a paper cone diaphragm of about 7 in. diameter, to one of axial sound pressure rising at a uniform rate of about 2.5 db per octave. Diaphragms which produce a quite smooth characteristic of this kind for frequencies of 100 up to about 4,000 c/s can be manufactured by existing processes. The authors do not favour attempts to increase the response at higher frequencies by any means involving sacrifice of the smoothness of response already attained over the main audible spectrum. They prefer, in the absence of a diaphragm with smooth response up to higher frequencies, to expand the frequency range by a separate high-frequency unit, in cases in which such a step is justified.

Constructional Preferences

To avoid laying down expensive additional plant, departures from usual construction have been made only where experiment indicated that sufficiently improved quality of performance would result therefrom. No modifications have been made which affect appreciably the sensitivity, except that any elimination of pronounced resonances tends to reduce the sensation of loudness of transmitted sounds. The discussion is concentrated on frequency distortion, since no evidence has been found that non-linear distortions of well-designed modern loudspeakers exert any comparable adverse influence on the quality, at volume levels suitable for an ordinary living room.

A permanent magnet not greater than 250 cm.^{3} overall size, generating 6,000 lines per cm.^{2} in an air-gap of 1.075 in. external and 0.98 in. internal diameter and 0.25 in. deep is specified.

No substantial evidence was found that commercial methods of construction of coil and coil-former imposed any limitation on the performance of the loudspeaker. Additional stiffening of the coil former was not found to make any appreciable change in the frequency characteristic.

Simple auxiliary precautions towards ensuring true axial movement of the coil in the air-gap are: (1) taking out the leads to the coil at opposite ends of a diameter, to ensure symmetry of the mechanical load due to the leads; and (2) taking out the leads at the same winding level, i.e., winding an even number of layers. This eliminates any resultant current in the coil, in the direction of the axis, which could set up forces tending to twist the coil.

For a loudspeaker to be used in an enclosed casing the contribution of the centring devices to the total stiffness should be negligible. The limitation of the frequency range at low frequencies is then determined by the size of the casing. The stiffness can be reduced by replacing the usual cloth surround by an air-gap between the diaphragm and the frame, bridged at three points spaced equally round the diaphragm by straps of unstretched tape which support the diaphragm.

With some commercial constructions the apertures in the framework are insufficient to provide complete freedom of movement of the air behind the diaphragm. The authors limit the part of the framework between the inner plate and the outer rim to four strips each $\frac{3}{4}$ in. wide.

At present the authors find it possible only to specify one make of cone, moulded paper, and initially one per cent. of those obtained for P.O. contracts will be subjected to acceptance tests. There is some promise of obtaining improvement of response at higher frequencies without sacrifice of performance over the main frequency range by a suitable shape and manufacture of flared diaphragm. Latitude is allowed to the contractor over details which are not considered likely to affect the performance, e.g., the shape and size of the magnet.

The case consists of a box of $\frac{3}{8}$-in. plywood with an aperture 8-in. diameter in the front. The two sides and back are lined in the following order with felt (about $\frac{1}{4}$ in. thick); lead sheet (8 oz. per sq. ft.); corrugated packing paper (with the corrugations inwards). The top and bottom are lined each with rectangles of the felt and corrugated paper, which serve to hold the linings on the sides and back in position. No adhesive should be used; two or three light tacks through the linings of the top and bottom only should be used to retain the linings in position. Two layers of felt on the back of the front panel are held round the aperture to form a bag surrounding the back of the loudspeaker unit, when in position. The case dimensions are 16 by 14 by 8.5 in.

High-voltage Alternators

OPERATING experience of high-voltage alternators is reviewed in a paper by Mr. W. D. Horsley (C. A. Parsons & Co., Ltd.) which has been issued by the Institution of Electrical Engineers.

The first 33-kV concentric conductor alternator was commissioned in August, 1928, in the North Metropolitan Co.'s Brimsdown generating station, and has been in trouble-free service for over eleven years. Since then thirty-three alternators of this type have been installed or are being constructed, ten for South Africa, three for India, two for Australia and the remainder of the machines for use at home. Their capacities range from 24,000 to 62,500 kVA with an aggregate of 1,400,000 kVA. Nine operate at 1,500 RPM and the others at 3,000 RPM and twenty-one have been in service for 69 "machine years" with complete reliability and freedom from trouble. Two machines of this type have been made under Parsons licence by the English Electric Co., Ltd.

Difficulties have been experienced with four sets out of twenty-one. In chronological order they have been related to conductor insulation, joint insulation and over-potential caused by neutral inversion. The steps taken to remedy these defects are outlined in the paper, which also briefly describes new "vacuum pressure" impregnating plant capable of accommodating stators of over 130 tons in weight and 26 ft. long, sunk in a pit in the shop floor. Improvements in the construction of concentric conductors and their joints are described as modifications in detail rather than changes in general form.

The bushes that form an important part of joint insulation are now somewhat similar to those used for commutator V-rings. They are built up of layers of overlapping strips of micanite, formed by pressing and moulding at high temperature and pressure. Trimming by turning with a diamond tool ensures uniform thickness within one-thousandth of an inch of the correct dimensions. Soldering joints is facilitated by electric heating and drying out prior to impregnation, is done by combined circulation of heated air and electric current through the windings.

The last section of the paper is concerned with system operation, showing that fresh problems are not involved. Triple-harmonic circulating currents causing telephone interference, or overheating of earthing resistors, have been similarly ex-

perienced for a long time on lower-voltage systems and the remedy has usually been simple.

There is no objection to operating a 33-kV concentric-conductor alternator with an insulated neutral. The insulation to earth is ample to withstand the over-voltages which occur in service. The only precaution it is necessary to take is to avoid the possibility of neutral inversion.

Nor is there any objection to the use of arc-suppression coils in conjunction with high-voltage concentric-conductor alternators. In the event of a permanent earth fault occurring on the system the effect of the coil is to maintain indefinitely the neutral point of the system at phase potential above earth. In the 33-kV concentric-conductor design the maximum potential of an outer conductor to earth, with one terminal earthed, is limited to 23 kV. The thickness of the insulating tube normally provided is ample to withstand this condition.

The standard type of different protection has proved satisfactory for high-voltage alternators. Only one failure between sections has occurred, and with the improvements which have been made in the joint insulation no further difficulty need be feared. A form of inter-turn protection using wattmeter-type relays and requiring no tappings to the stator winding has recently been developed on Tyneside which should be suitable for the concentric-conductor type of winding.

Protective Relays

HOW relays and associated protective equipment are maintained on a transmission and distribution system in South Australia is described in some detail in a paper by Mr. J. R. Brookman (Adelaide Electric Supply Co., Ltd., of which Mr. F. W. H. Wheadon is managing director) that has been issued by the Meter and Instrument Section of the Institution of Electrical Engineers.

The author enumerates the several protective systems employed on his networks, mentioning that both British and American relays are used together with telephone-type relays in connection with some of the pilot-wire schemes and for the indicating circuits. Operating results are tabulated and analysed, revealing a protective efficiency of over 90 per cent. This is contrasted with what the author describes as the "deplorable" results shown by the E.R.A. Report F/T94 of 1936 on the same subject, the reason for which he attributes to inadequate maintenance.

The requirements for successful protection are summarised as correct design of protective system, bench tests of relays before installation, careful installation and setting in accordance with calculated short-circuit values, and tests simulating fault conditions to verify performance.

There should be routine inspection and maintenance of relays and associated equipment several times per annum, yearly overhaul of circuit-breakers, and bench tests of relays every three or four years. Records must be kept of all inspections and tests; inquests should be held into all protection operations and reports made on their correctness or otherwise in comparison with the design.

Inspection and operation reports must be tabulated and compared, to permit modification of the protective system and the relay settings from time to time in accordance with growth of load and extensions of the network.

In view of the important duty they have to perform, one would like to see protective relay systems approach much nearer 100 per cent. efficiency than they do at present. In railway signalling relays, for instance, the percentage of error has been reduced to a small fraction of one per cent., as is also the case with telephone relays in automatic exchanges.

There are several reasons why the accuracy of protective power relaying falls so far below that obtained in railway and telephone work. In those cases the relays are in continual operation, many times a day, and faults in design and construction are soon detected and eliminated. Protective relays, on the other hand, operate at very infrequent intervals and perhaps only after standing still for months, or, if neglected, for years. Another reason is that signal and telephone relays operate under closely controlled conditions, while protective relays have to deal with a wide range of fault conditions, sometimes accompanied by surges.

Overload Protection

METHODS of grading overload inverse-time relays, with definite minimum time, for the protection of an 11-kV network are discussed in a paper by Messrs. J. W. Gallop and R. H. Bousfield (Bournemouth and Poole Electricity Supply Co., Ltd.) which has been issued by the Transmission Section of the Institution of Electrical Engineers in London.

A method has been devised of reducing tripping times throughout, especially at the source of supply, allowing a large number of relays to be used in series. The authors feel that there are growing tendencies to lose sight of the potentialities of overload protection, owing to the superior performance of other systems; and also to install additional protection where, in some cases, it is not necessary.

For overload grading to be carried out with confidence it is necessary to know the values and distribution of fault currents. The authors show that the maximum possible fault current at any point in the network determines the values of the relay settings to ensure discrimination under all fault conditions. Grading is often done on the assumption that the relays function in a saturated condition; that is in minimum time, controlled only by the time-setting multiplier. The plug-setting is then used to regulate the pick-up current of the relay, i.e., to protect the plant against prolonged overload. But numerical examples show that unless certain precautions, discussed by the authors, are taken in selecting current plug settings incorrect operation may occur at low values of fault current.

The system described is said to have several marked advantages, but requires considerable initial labour in its preparation. A very complete record of network calculations is needed and for this purpose the authors have devised a method whereby a number of diagrams form the permanent record of the system constants, including emergency relay settings.

Oil Engines in Africa

THE maintenance of heavy-oil engines in West Africa was the subject of a paper by Mr. H. J. P. Hopkins presented for discussion at a meeting of the Diesel Engine Users' Association in London on December 14th.

A general maintenance chart was suggested from experience based on the operation of heavy oil engines installed for generating electricity for use in mining work. In 1934 two horizontal four-cylinder, four-cycle, 500-BHP engines were installed, each coupled direct to a 375-kVA, three-phase, 50-cycle alternator. A six-cylinder set was added in 1935 and another in 1936. The paper explains the various troubles encountered in service and gives the cost for 1936 as £81 9s. 7d. (three engines), for 1937 as £84 3s. (four engines) and for the first four months of 1939 as £58 15s. 4d. (four engines). The cost per kWh generated, exclusive of depreciation, fell from 0.763d. in 1934 to 0.4d. in 1937. The station was staffed entirely with native labour under the supervision of one European engineer.

The Galloway Scheme

MR. F. H. WILLIAMS, manager of the Galloway Water Power Company, in a recent address to the Royal Scottish Society of Arts at Edinburgh, said that the scheme was an accomplished fact, and was doing not only all that was claimed for it but even more. He said it filled one with surprise that for hundreds of years this water should have run to waste. By the scheme, at a cost of just under £3,000,000, about 150,000 HP was developed and some 200 million kWh of electricity was generated yearly.

Dew on Insulators

THE frequent occurrence of faults on transmission lines at about dawn has led to experiments being carried out in France on the effect on strings of suspension insulators of dew which is formed when the heat of the sun evaporates the moisture on the ground, thereby increasing the humidity of the air, which on rising comes into contact with the cold insulators. The tests were made on suspension insulators with a tested flashover voltage of 85 kV.

The insulator was chilled for twelve hours in a refrigerator to 2 deg. C. and then placed in an atmosphere of 18 deg. C. in a room in which a pan of water at about 22 deg. C. was placed. The insulator was carefully wiped and then left to form dew. Flash-over voltage was found to be about 80 kV. or nearly its original value. A second test was made on insulators taken from a chain in service. These were not wiped, but kept in their original condition. Tests before refrigeration gave a flash-over voltage of 60 kV, considerably below the figure for a new insulator. After formation of dew, the flash-over voltage was 34 kV. Tests with insulators on to which various kinds of dust had been deposited were then made. Cement and fine dust from a room both gave flash-over voltages of 24 kV.

A further test made with an insulator which had hung in the laboratory for about six months and had become covered with dust gave a flash-over voltage, after deposit of dew, of 27 kV. On the other hand, an insulator which had been dusted over with dust from a road gave 40 kV flash-over voltage. A test of another kind was also made by placing an insulator in a bird-cage for a week to allow it to be covered with excreta. The dust was then carefully cleaned off and the flash-over test made. This gave 79 kV dry, but 36 kV with dew. It would seem, therefore, that both bird excreta and dust, particularly the finer types, regardless of origin, help in the formation of dew under proper conditions of temperature and humidity, thus considerably lowering the flash-over voltage.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

THE general manager of the Hull Corporation Electricity Department, **Mr. D. Bellamy,** recently offered to assist in the management of the city's transport undertaking, the manager of which, Mr. J. Lawson, recently died. The Electricity Committee has decided that he should be allowed to do so for the time being, at the request of the Transport Committee. It was stated at a meeting of the City Council last week that efforts to secure the release from his military duties of Mr. Lawson's chief assistant, Mr. Read, had so far been unsuccessful.

The board of directors of the County of London Electric Supply Co., Ltd., has elected **Sir Robert Renwick, Bt.** (vice-chairman) as chairman of the company in succession to the late Sir Bernard Greenwell, Bt. Sir Robert Renwick joined the board of the company in 1928 and on the death of his father, Sir Harry Renwick, in 1932 became vice-chairman. With the expansion of the County group of companies, now numbering twenty-one, into the largest electricity supply organisation in the country, there was formed within the group an Executive Committee for the day-to-day management of the organisation, and Sir Robert Renwick became chairman of this committee in 1932. Sir Robert is a stockbroker who is already well known in the electricity supply industry has an intimate knowledge of all branches.

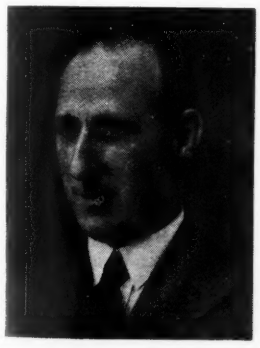
Sir Robert Renwick, Bt.

Lord Gainford, who has been a director of the company for nineteen years, becomes deputy chairman. He retains the chairmanship of the South London Electric Supply Corporation, Ltd., an associated company, but in respect of the other associated companies Sir Robert Renwick has been elected chairman in place of the late Sir Bernard Greenwell.

Mr. A. J. Devine has been appointed a director of E.P.I., Ltd., of Liverpool. He has been with the company for twenty-one years, and in recent years has occupied the position of manager. Among the large contracts with which he has been concerned was the electrical installation work in the Mersey Tunnel.

Sir Harry Brown, who recently resigned from the position of Director-General of Commonwealth Postal Services, has accepted an offer to join the British General Electric Co., Pty., Ltd., and will be associated in the management of the company with the managing director, Mr. E. Hirst. Sir Harry was to commence his duties early in the current month when the company commenced manufacturing in Australia on a large scale.

Mr. P. Wardle, A.M.I.E.E., chief engineer and general manager of the Cannock Urban District Council Electricity Department, has been appointed general manager of the Macclesfield electricity undertaking which has recently been acquired by the Corporation from the Electricity Co. of Macclesfield, Ltd. His salary will be £945, rising to £1,080.



Mr. P. Wardle

Mr. Wardle was educated at the National School, Leigh, and the Municipal College, Leigh, and received his technical education at the Leigh and Rochdale Technical Colleges. His early training was received at the central power station of the Lancashire United Tramways & Power Co., Atherton. In 1909 he was appointed charge engineer at Rawtenstall, when the station first commenced operation, and later became mains superintendent. From there he went to Carlisle, where he took up a similar position, and he subsequently was appointed mains engineer at Walsall. He joined the Cannock undertaking in 1930, taking up his present position of chief engineer and manager. Since his association with this undertaking it has developed very rapidly, and in our issue of September 22nd we published an article showing how the load has been built up under his guidance.

In June, 1936, Mr. Wardle was elected a member of the I.M.E.A. Council, and he is a co-opted member of the Consultative Technical Committee of the C.E.B. Central England Area. He was chairman of the Central England Area Committee of E.D.A. last year.

A festive atmosphere pervaded the dinner-dance of the London Students' Section of the Institution of Electrical Engineers—its second social function of the season—which was held at Lysbeth Hall, Soho Square, W.C., last Saturday, when about 170 sat down to excellent Christmas fare. As had been previously announced, the occasion was quite informal, and **Mr. A. H. Young,** chairman of the Section, sounded the keynote for the evening when he said that his remarks were to be confined to greeting the guests. In this connection he welcomed the presence of Mr. Johnstone Wright, President of the Institution, mentioning that this was the first social function he had attended since he had taken office. In these days of strain a certain amount of relaxation was essential. The section was arranging a full programme of meetings of the second half of the session. In welcoming Mr. E. W. Cuthbert, of the Institution of Civil Engineers, he expressed the hope that the annual dance with the Civils and Mechanicals would be held in February. He thanked Mr. P. H. Pettifor, the hon. entertainments secretary, and his committee, for the success of the arrangements.

Mr. Johnstone Wright congratulated the Section on keeping the flag flying in difficult times, and mentioned that all sections of the Institution were resuming their meetings early in the New Year. The dinner over, the floor was quickly cleared and the remainder of the evening was given up to dancing.

In addition to the sales staff already covering the country for the sale of "Ekco" lamps, E. K. Cole, Ltd., has appointed three specialist representatives for consultation. **Mr. A. H. Heuthwaite** (Yorkshire and N.E. Lincolnshire) is well known in the North of England and Midlands where, for the last eighteen months, he has been engaged on special organising work for the Electrical Industries Benevolent Association. Previously, he was with Crompton Parkinson, Ltd., attached to their Yorkshire sales depôt. His home address is 80, Wensley Drive, Leeds. **Mr. G. G. Hazard** (Greater London) has had thirty years' experience in the electrical industry—on the supply side with the St. James & Pall Mall Electric Light Co., Ltd., and on the lamp sales side with A.E.G., Neron, and later, for over ten years, with Siemens. In recent years he has been engaged in other branches of the electrical industry. His telephone number is Hendon 2589. **Mr. C. Clements** (Midlands) has been associated with lamp marketing for many years, most recently on behalf of Crompton Parkinson, Ltd. Formerly he was with Philips Lamps, Ltd. His home address is 129, Beauchamp Avenue, Handsworth, Birmingham, 20.

Messrs. C. Clements, G. G. Hazard and A. H. Heuthwaite

Mr. J. H. Low, charge engineer at Dunston "B" power station, who has been in the service of the North-Eastern Electric Supply Co. for over 30 years, has been presented by the staff with a radiogramophone on his retirement. Before joining the North-Eastern Co. Mr. Low was on the staff of the Cleveland and Durham Electric Power Co.

Mr. O. D. Young, chairman of the General Electric Co. of America, and **Mr. G. Swope,** president, are retiring from these positions at the end of the year, but have been elected hon. chairman and hon. president respectively. They will be succeeded by **Mr. P. D. Reed** (as chairman) and **Mr. C. E. Wilson** (as president). Mr. Young, who is sixty-five years of age, joined the company in 1913, and he was responsible for the organisation of the Radio Corporation of America. Mr. Swope was born in 1872 and joined the General Electric Co. as a helper in the Chicago service shop. He became president in 1922.

Obituary

Mr. T. Gladdy.—We regret to announce the death of Mr. Thomas Gladdy on December 7th, at the age of seventy years. He had been connected with the ownership and management of Trevelvans (Birmingham), Ltd., since March, 1916. Prior to that date he was for many years with Siemens Bros. Dynamo Works, Ltd., London, in their Supplies Department.

TWO-PART TARIFF CHALLENGED

Judgment in the Wimbledon Case

IN the Chancery Division, on Wednesday, Mr. Justice Simonds delivered his considered judgment in the action brought by the Attorney-General at the relation of Major C. H. Stevens of Wimbledon and by the Major as a second plaintiff against the Wimbledon Corporation, claiming a declaration that the Corporation's two-part tariff for electricity supplied to the Major's house was invalid and *ultra vires*. The plaintiff also claimed a declaration that the Corporation was not entitled to supply consumers of electricity on the terms of its two-part tariff and an injunction to restrain the Corporation from so doing. Plaintiff further claimed a declaration that all consumers in the area of the Corporation were entitled to be supplied with electricity under a two-part tariff imposing uniform terms.

Major Stevens alleged that in October, 1936, he discovered that having regard to the type and size of the house he occupied he had been overcharged and he protested against the fixed charge of £15 by the Corporation. The Corporation by their defence alleged that in October, 1936, Major Stevens had inquired what maximum demand he was entitled to make and yet obtain a two-part tariff and he was told that if his maximum demand was reduced to 2½ kW at the times of peak load his fixed charge would be reduced to £7 0s. 6d.; that the Major accepted those terms, but later withdrew from them.

The main question in the case was whether or no the two-part tariff was invalid on the ground that it offended in certain ways against that which the Corporation had power to do. The material facts and evidence in the case were reported in the ELECTRICAL REVIEW of November 24th and December 1st.

Mr. Justice Simonds, in delivering his considered judgment, said the defendants' powers were governed by the Electricity Supply Act, 1899, Section 33 of which gave them power to charge by certain methods. The defendants took advantage of this and introduced the two-part tariff which they used by agreement with the consumers. The claims of the plaintiffs were supported by a number of contentions. To say that it was not permissible for the defendants to make charges under the two-part tariff was a mistaken contention, but in his opinion the system adopted was a bad one. He had to judge this case on the facts and he came to the conclusion that he could not make the declaration on the broad lines proposed by the plaintiffs.

The defendants obtained some of the supply from a source other than their own. Here there was a fixed charge made and Major Stevens asked the defendants how they made out the charges. The defendants' chief engineeer replied to this inquiry and his Lordship thought that if the engineer had shown a little more candour these proceedings might have been avoided. Major Stevens was willing to pay what he considered a fair charge on his house in comparison with other houses of the same character in the neighbourhood. The chief engineer differed from this and pointed out that they were not similar houses and refused to give details as to how the fixed charge was made up.

It was a striking fact that the chief engineer did not disclose the facts till he was in the witness box—that of special assessments on the load system. It was for the defendants to justify what they had done. A scrutiny of the special assessments showed that a number of cases were disclosed in which assessments were made which should not have been made. The engineer acted on a basic system. In all the circumstances the plaintiff was not entitled to the declarations claimed; he was only entitled to a declaration in accordance with Sections 19 and 20 of the Act of 1899.

The claim to full maximum charges could not be justified. The charges made were due to careless disregard of the restrictions. Major Stevens was entitled to be charged in comparison with other and similar houses and no undue preference must be shown.

His Lordship said that the attempt to impose on Major Stevens alone among consumers a limit of maximum demand could not be justified. It was much to be deprecated that any local authority should endeavour, as the defendants had done, to conceal the basis and methods of charges. Adjustments of an arbitrary nature were in any case to be avoided. To make such adjustment behind a screen and when information properly sought was denied paved the way to suspicion and discontent. If the result of the plaintiff's action was to end a system in Wimbledon which had, as his Lordship understood, been adopted by no other electricity undertakers he would have done good service to the community.

His Lordship accordingly held that Major Stevens was entitled to be supplied by the defendants with electricity on the same terms as any other person in the area and in the circumstances he directed that the defendants should pay Major Stevens seven-eighths of the costs of the action and gave judgment accordingly. He refused leave to appeal to the Court of Appeal on the order as to costs.

Parliamentary News

By Our Special Reporter

London Electricity Charges

ON December 6th Sir W. Davison asked the Minister of Transport whether he was aware that certain London electricity companies had given notice to increase their charges owing to the reduction of consumption by reason of the black-out and the evacuation policy of the Government whereby many of their consumers had left London; and, in view of the serious hardship thereby occasioned to those citizens who had to remain in London for national or business reasons, what action the Government proposed to take in the matter.

Captain Wallace said he was aware that owing to the circumstances mentioned, and to increasing costs, certain London electricity companies, in common with various public authorities owning electricity, and gas undertakings, had found it necessary to increase their charges. The increases had not required his statutory approval, but he was keeping the position under careful observation.

Battery Vehicle Production

Mr. Grenfell asked the Minister of Supply if he was prepared to release the materials necessary for the production, on a substantial scale, of vehicles propelled by electric batteries, since this would mean a considerable saving in oil imports and shipping.

Mr. Burgin said he would, of course, be prepared to give careful and sympathetic consideration to any application for materials for the production of electrically propelled vehicles. Such an application would require consideration in relation to the requirements of materials for other purposes and the circumstances existing at the time when it was made.

Electricity Rationing

On December 7th Mr. Pethick-Lawrence asked the Secretary for Mines whether the 100 per cent. electricity ration was still in force for private households; and, if so, what steps householders, who had special circumstances which made it necessary for them to ask for more than 100 per cent. of last year's supply, should take to secure that they be allowed a larger amount.

Mr. Lloyd said that rationing of electricity (as well as of gas and coal) was still in force on the basis of 100 per cent. of previous consumption. As regarded the second part of the question householders should apply to their Local Fuel Overseers who had power to grant an increased allowance where they were satisfied that special circumstances warranted it.

Electricity Output Statistics

Captain Shaw asked the Minister of Transport on December 12th why the Electricity Commissioners had ceased to publish monthly figures showing the amount of electricity generated; and if he would request them to resume publication as from August last.

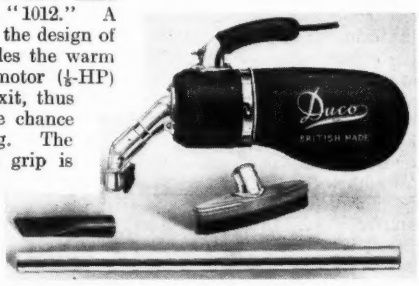
Capt. Wallace said that the publication of these monthly figures in present circumstances was not considered to be in the public interest and, as at present advised, he did not see his way to ask the Electricity Commissioners to resume publication.

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

Hand-type Cleaner

BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2, have added to their "Duco" range of vacuum cleaners a new hand model, model "1012." A feature is that the design of the body enables the warm air from the motor (⅛-HP) to have free exit, thus minimising the chance of overheating. The rubber handle grip is specially designed to give a comfortable hand-hold and the care exercised in maintaining "balance" reduces vibration and gives the maximum air displacement and suction.



"Duco" hand-model vacuum cleaner

The cleaner weighs 4¾ lb. and is supplied with 7 yd. of twin rubber-covered cable and a universal plug adaptor. Accessories comprise an extension tube, a suction nozzle, an oval brush and a flat suction nozzle to which a narrow brush can be fitted.

Public A.R.P. Signs

Many manufacturers have already brought out special units to conform with the recently issued BS/ARP32, which covers illuminated location and direction signs for air raid, report and control centres, fire stations, cleansing depôts, wardens' posts, fire alarms, hospitals, first-aid posts and police stations. The "Mazdalux" internally illuminated signs, of which immediate deliveries can be made by the BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Kingsway, London, W.C.2, can be supplied in vertical or horizontal types (24 in. by 12 in. lettering space), single or double sided and fitted for wall or bracket suspension.

Horizontal-type "Mazdalux" A.R.P. sign

The signs are equipped to accommodate two 15-W lamps and can be supplied with any of the standard lettering. Special features are the robust sheet-metal weatherproof construction, good daylight appearance, maximum contrast between letters and background, uniform brightness and no spill light.

A complete range of equipment introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, includes illuminated box signs, front illuminated signs, front sign illuminators and lettered panels for daytime signs. A box sign made of lead-coated sheet-steel with stiffening straps has lettered glass panels of shatter-proof wired glass. Each unit is supplied complete with top screen and lighting unit incorporating a b.c. lampholder for a 15-W pearl g.s. lamp. A front illuminated sign is also constructed of lead-coated sheet-steel with stiffening straps and is furnished with an interchangeable lettered panel and top screen. A special lighting unit and b.c. lampholder to give complete cut-off at the edges is included, so that no light can escape either down on to the road surface, or upwards into the air. A great advantage of this sign is that it has no glass. Information additional to the standard notice panel can be painted on to the top screen where required. The panels themselves can be obtained either weatherproof painted or in vitreous enamel finish.

G.E.C. "Z.3110" A.R.P. street indication signboard

Fixing straps enable the G.E.C. sign illuminator to be fitted on the back of existing wooden signboards while lettered A.R.P. panels, for which there is available a wide variety of notice panels, are pierced for screwing to wooden boards or other mounting backgrounds.

In addition the company is supplying lighting unit aids to movement—the "Z.3100" advance direction sign lighting unit, which can be adapted for any shape or size of signboard up to 5 ft. wide by 4ft. high, and the "Z.3110" A.R.P. street indication signboard, 12 in. high by 10 in. wide, which can be used for indicating road route numbers, works private roads, and for shelter or other A.R.P. signs on works roads, &c. For fixing these units to circular poles flat pole straps can be supplied.

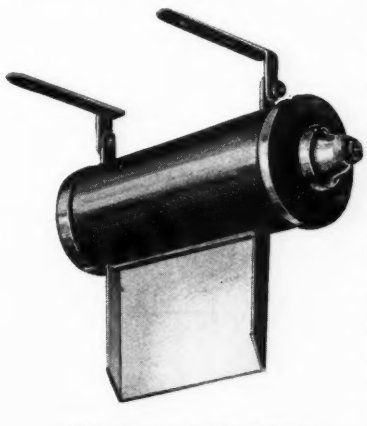
Illuminated Shop Signs

The EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2, is now marketing a strongly constructed illuminated metal sign, 16 in. wide by 13½ in. high, suitable for hanging at the door or in the window; it will also stand on the floor of the window. The letters on the front screen are formed in unbreakable translucent material, from which a white opalescent effect is obtained. By means of a special light-output reducing device, the light intensity is controlled to conform with the regulations, providing a 15-W pearl lamp is used. The trade name "Baker," "Butcher," "Chemist," &c., appears above the word "Open," and so far fifty-three of these trade names have been produced. Slogans for specialised trades can also be supplied if desired.

"Ediswan" shop sign

Shop Window Lighting

As mentioned last week the GENERAL ELECTRIC CO., LTD., has also brought out a special window display cabinet fitting conforming with BSS/ARP/35. The fitting, which is suitable for use with various sizes of display cabinet, comprises a horizontal metal cylinder with two end caps, one with a hole to take a bakelite cord-grip lampholder. The cylinder has a narrow longitudinal slit on the underside glazed with frosted glass clipped in. On the outside immediately behind this slit is mounted a flat reflector with a matt white enamel surface, which provides the required cut-off and directs the light on to the goods. Apart from this reflector, the whole fitting is finished dead black inside and out. Two hinged fixing brackets with 5/32-in. holes are provided at the top, enabling the angle of the fitting to be adjusted as required. The fitting is designed for use with a 15-W pearl lamp.

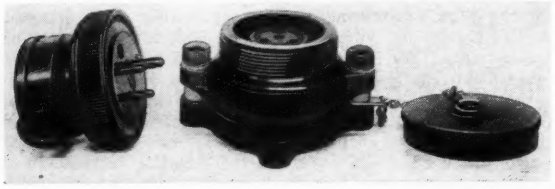


G.E.C. display cabinet fitting

A range of G.E.C. box signs with suitable interior fittings to give the permissible illumination has been designed to ensure the minimum variation in brightness. The lighting unit consists essentially of a metal cylinder having suitably placed apertures for emitting the light and an opening in the top to take a bakelite lampholder of the cord-grip shade-carrier type. The finish is matt white outside and dead black inside. This unit also is designed for use with a 15-W pearl lamp. Similar conversion units are all of one size but arranged for use in signs of different dimensions, enabling the light emitted to be increased proportionately with the size of the sign.

Industrial Plug and Socket

To extend the usefulness of their industrial wiring system, BRITISH INSULATED CABLES, LTD., Prescot, Lancs, have added to the fittings available a 5-A, three-pin plug and socket. The base is similar to that of the switch box, being provided with the usual sealing gland, ferrules and washers to resist the



5-A, three-pin plug and socket for B.I. industrial wiring system

entrance of contaminated air or moisture. In this base is mounted a standard 5-A, three-pin socket.

The plug is fitted with a rubber washer, a locking ring and a gland for entry of a t.r.s. flexible cord, with an anchorage eye for attachment of heald cords. A protecting cover is provided for screwing on to the base in place of the locking ring when the plug is withdrawn.

Grinder Improvements

Improvements have been made to the heavy-duty and standard type "Delco" grinders supplied by DELCO-REMY & HYATT, LTD., 111, Grosvenor Road, London, S.W.1. The former is of even heavier construction than previously, its total weight being now 60 lb. The design, too, has been made more streamlined so that there is greater clearance and improved wheel accessibility.

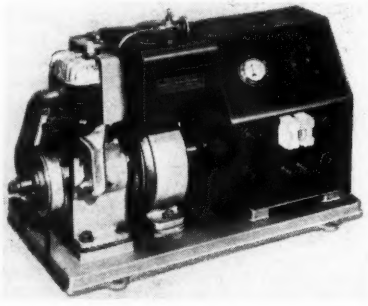
Delco heavy-duty grinder

At the back of each wheel-guard there is an opening for the ejection of dust, and provision is made for the fitting of eye-shields. Tool rests are universally adjustable and various extra equipment is available, including shaft extensions to carry wire brushes and polishing mops.

The heavy-duty machine has a permanent condenser type motor with a large overload capacity and a nominal rating of ½ HP at 2,850 RPM. Two 7-in. dia. by ¾in. wheels are fitted as standard, one fine and one coarse grit. The lighter model has 6-in. wheels and a ¼-HP motor of split-phase construction. The base, which has a large area to ensure rigidity, has a flush switch incorporated, rubber feet prevent vibration. Both models are available for use on single-phase AC.

Portable Generator

The "Pygmylyte" portable electric generator set, type "A.M.," is the latest addition to the products of BRABY'S ENGINEERING WORKS, LTD., Ditchling, Sussex. The engine is a 1¼-HP four-stroke air-cooled unit driven by petrol, paraffin or gas. Flywheel ignition with advance and retard lever, a ball-bearing crankshaft and a light alloy piston are incorporated, the suction type carburettor being of new design with adjustable throttle and choke. An instrument box mounted on the base contains an ammeter and push-button starting equipment, and a wire rope starter is provided for manual use. The petrol consumption is ¾ pint per hour. Ball-bearing type generators can be fitted from 12/15 V, 360 W upwards. The whole unit is portable and is mounted on an aluminium base plate complete with carrying handles. Applications of the set include the lighting of small country houses, farms, camps and yachts, A.R.P. emergency lighting, pumping, and battery charging. Its uses for A.R.P. work are especially noteworthy, as the unit is completely self-contained.



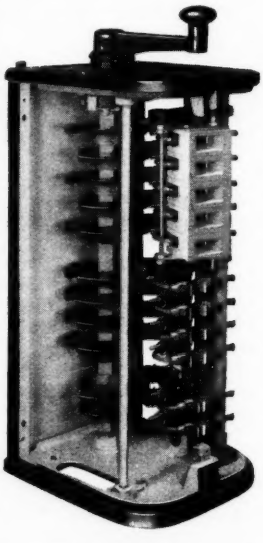
"Pygmylyte" portable generator

Plastic Luminous Material

A new luminous material, "Lumic Plastic Light," made by JARRETT, RAINSFORD & LAUGHTON, LTD., Kent Street, Birmingham, appears to have innumerable uses in the black-out. As its name implies, the material is plastic and if exposed to daylight or artificial light attains in the dark a brilliance which lasts for a considerable time. It is available in strip form in a variety of colours and wire reinforced at the edges.

Cam-operated Contactor Controllers

Where continuous service and severe duty are concerned the cam-operated contactor controller is a good alternative to the drum type for industrial purposes. The reason is that the contacts have a longer life and are more easily replaced at a far lower cost. That cam controllers have not been in more general use has been due primarily to their higher initial cost and to a certain amount of stiffness in operation. To overcome these difficulties the "Smithson" patent design has been evolved by J. G. SMITHSON & Co., LTD., Melchett Road, King's Norton, Birmingham.



Smithson standard industrial 75-A AC controller

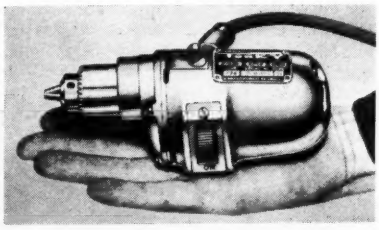
The snap-trigger action employed gives a positive quick make and break, avoiding the risk of arcing or welding, and incorporates slow-lift cams for easy positive operation. A pressed-steel construction enables these features to be provided at a price competitive with that of drum-type controllers, while the standardisation and interchangeability of contacts greatly reduces the range of spares necessary.

The design of the contactor unit is exceptionally simple and sturdy. The moving parts, *viz.*, the main and operating levers, are pivoted on hardened steel knife-edge bearings and are held together by a double operating spring. Contacts are opened and closed by the operating lever working on a cam, while the movement of the spring pulls the main lever over dead centre, thus opening or closing the contacts with a snap action. Any wear is automatically taken up by the spring.

Among the various machinery for which the standard controllers are supplied are cranes, locomotives, winches, battery trucks and vehicles, capstans, lifts, &c. Any type of operating gear can be supplied.

Light-weight Drills

The outstanding features of the new "Torky" ¼-in. ball-bearing drill made by S. WOLF & Co., LTD., Pioneer Works, Hanger Lane, Ealing, London, W.5, are its compactness—the overall length is 6½ in.—and its lightness, the weight in the case of the "TH.2" trigger switch pistol pattern being only 2 lb. 4 oz.; the "TP.2" thumb operated slider switch model weighs 2 oz. more.



Wolf "TP.2" drill

Both the armature and the drilling spindle are mounted on ball bearings while the gears, which are of the spiral type, are of special heat treated nickel chrome steel. The drill spindle speed running light is 2,500 RPM and on full load 1,657 RPM. These speeds have been found the most suitable for drilling holes up to ¼ in. in diameter in duralumin and the other metals on which the machine is likely to be mainly used. On full load the current consumption is approximately 166 W. Among the tests to which the company has subjected the machine with entirely satisfactory results is a full load test for 1,000 hours. Each drill is supplied complete with 15 ft. of three-core c. t.s. cable, ¼in. three-jaw keyed chuck and a spare pair of carbon brushes.

A.R.P. Lamp Shield

The "Burlington" metal lightshade, made by L. WESTACOTT DAVIS, 88, Redcliffe Hill and Guinea Street, Bristol, is copper plated and lacquered. It measures 7 in. long and 7 in. in diameter and takes a standard cord-grip lampholder.

NEW BOOKS

Testing Electrical Plant. A.C. Textbook. Suppressing Radio Interference

Electrical Testing for Practical Engineers. By G. W. Stubbings. (Pp. 252; figs. 114.) E. and F. N. Spon, 57, Haymarket, London, S.W.1. Price 8s. 6d.

This new volume, emanating from a well-known author, will be especially welcomed by practical engineers engaged in the erection, operation or maintenance of electrical plant and machinery. While there is no lack of comprehensive treatises for the specialist testing engineer, these practical people have not been so favoured, and the new book will go far to make up the deficiency.

Written in Mr. Stubbings' usual attractive style, the book deals with practical testing in a simple and informative way. No proofs of formulæ are given, and the use of mathematics has been avoided. The early chapters deal with the use of testing instruments of all types, current transformers and artificial test loads, basic electrical tests and measurements and practical power measurements.

There is an especially useful chapter on installation testing, including earth resistance tests. The tracing of faults in wiring and buried cables, short-circuits and earth faults is dealt with in an effective manner, and the clear diagrams should be of assistance to those concerned with this work. Three-phase testing, checking instrument and relay connections, are given adequate attention, and every type of relay is included. The section dealing with power-factor and its correction should be commended for its simple treatment, and the book concludes with a chapter on the testing of electrical machines, including acceptance, commissioning and maintenance tests. Although the book is primarily intended for practical engineers, we can recommend it to the student and apprentice.—T. C. G.

Theory and Practice of Alternating Currents. By A. T. Dover. Third edition. (Pp. 591.) Sir Isaac Pitman and Sons, 39, Parker Street, London, W.C.2. Price 18s.

There are few better books on the theory and practice of alternating currents than this treatise, which has now reached its third edition. The new material includes chapters on single-phase and three-phase transformers and alternators, three-phase induction motors, transmission circuits and symmetrical components.

The author has wisely kept to the lines followed by the first edition, both in mode of treatment and the use of worked examples in the text. In addition, there are now some 250 numerical exercises with answers. As many of these are taken from papers set by the London University, City and Guilds of London Institute, and the Institution of Electrical Engineers, it will be gathered that the text is suitable for final-year courses of honours standard.

There is no need to stress the care that Mr. Dover has bestowed on his task, for this reputation he established long ago by his technical publications. One adverse criticism only occurs to me—the scarcity of references. This is not even redeemed by a name index, and the serious reader would often be grateful for more guidance. For those wishing to make a thorough study of AC working the present book can be thoroughly recommended.—S. P. S.

Radio Interference Suppression. By G. W. Ingram. Pp. 154. ELECTRICAL REVIEW. Price 5s. net.

The author states that the intention of this book is to serve as the bridge between the heavy and light current branches of the electrical engineering art and it is addressed to engineers engaged in the design, manufacture, operation and maintenance of electrical plant of every type, as distinct from those engineers who handle radio receiving apparatus.

The book is divided into five sections of which the first (14 pages) deals with the nature of electrical interference and its classification, while the second section (43 pages) deals with the production of interference by electrical plant and the design of suppression apparatus. The third and main section of the book is devoted to the industrial application of suppressors in twelve groups as follows:—Generators and motors; distribution systems; conversion plant; signs and interrupted circuits; neon signs and gaseous discharge lighting; domestic and portable apparatus; ignition systems and motor car interference; lifts, hoists and cranes, marine installations, electro-medical apparatus; traffic signals; and, finally, special cases.

The fourth section (four pages) presents elementary radio and transmission formulæ, while the fifth section contains a short bibliography and three appendices consisting respectively of an interference classification table, a suppression method table and notes on vertical anti-interference aerials.

In the rather restricted limits the author has contrived to present a large amount of useful information, although in one or two instances he has wandered into fields more proper to the subject of telephone interference particularly in dealing with voltages induced by power lines into telephone lines and in dealing with electrolysis.

One would have preferred to have seen more attention given to the reasons why high-frequency currents are produced in apparatus because a clear understanding of this is a guide to their prevention. Secondly, one would wish to have had the principles of suppression more clearly explained. For example, the reasons why inductors (chokes) or capacitors (condensers) are used either separately or together could have been more clearly presented with advantage and in this connection the influence of the impedance of the source in determining the most efficient means of suppression should also have been explained. Finally, we would have liked to have seen more information on the measurement of radio interference.

There are one or two minor points noticed in examining the book which could be appropriately corrected or amended in a later issue; on page 34 reference is made to a Fig. 13 which is obviously not the Fig. 13 (or any other fig.) printed. On page 5 it is stated that the inclusion of electrostatic shields in the mains transformers of receivers reduces interference currents passing from the mains to the receiver by direct conduction. Actually the insulation between primary and secondary winding is sufficient to prevent any current passing by direct conduction and the electrostatic shield prevents the passage of currents by the capacitative admittance between the primary and secondary windings. On page 15 it is suggested that impedance mismatching can cause harmonics in the output current produced by a pure sine wave; this is not the case. Regarding high-voltage power transmission lines the author gives a list of four causes of interference—none of these, however, is of importance compared with the most prolific causes not mentioned, *viz.*, corona and capacitative currents passing through air gaps in insulators. These are perhaps rather trivial points, but attention to them would enhance the value of the book.—A. J. G.

Shorter Notices

"Public Speaking for Technical Men," by S. Marion Tucker. (Pp. 396.) McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C.2. Price 20s.—Although it is agreed that speaking in public is one of the most useful and important attributes a man can possess, it is generally a matter for which little or no training is given and which has to be picked up as best one can. While covering the whole art most comprehensively, this book aims particularly at helping technical men to "get their thoughts across" in the most interesting and convincing manner. The book is largely an elaboration of a series of talks on public speaking given by the author before annual conventions of the American Society of Mechanical Engineers.

"Radio Service Trade Kinks," by Lewis S. Simon. (Pp. 269; figs. 27.) McGraw-Hill Publishing Co., Ltd. Price 20s. Tabulating information obtained from practical experience, this publication should be invaluable to the radio service engineer handling American receivers. The various makes and types of sets are given in alphabetical order, followed by notes on the faults to which each one is prone together with the means for rectifying them.

"Welding Review Year Book, 1940." (Pp. 173 ill.) Engineering and Technical News, Ltd., 18, The Covert, Petts Wood, Kent. Price 2s. 6d.—This is of convenient pocket size and covers both electric and acetylene flame welding as well as oxygen-flame cutting. Tabulated data are followed by general principles and procedure relative to different processes. The choice of electrodes and timing-control devices are two subjects of such importance as to merit more detailed treatment than they have received.

"Problems in Radio Engineering," by E. T. A. Rapson. Fourth edition. (Pp. 123.) Price 3s. 6d.

"Modern Radio Communication Vol. I," by J. H. Reyner. Seventh edition. (Pp. 334; fig. 156.) Price 5s. "Theory of Machines," by Louis Toft and A. T. J. Kersey. Fourth edition. (Pp. 474; figs. 284.) Price 12s. 6d. Sir Isaac Pitman & Son, Ltd., 39, Parker St., Kingsway, London, W.C.2.

"Electric Wiring," by W. S. Ibbetson. Sixth edition. (Pp. 264; figs. 136.) E. & F. N. Spon, Ltd., 57, Haymarket, London, S.W.1. Price 6s.

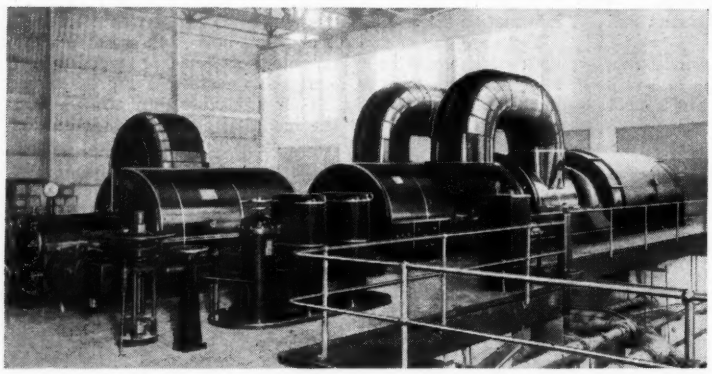
"Introduction to Electrical Machines," by A. W. Hirst. (Pp. 122; diagrams.) Price 5s. "Induction Motors," by S. Gordon Monk. (Pp. 126: diagrams.) Price 5s.—Blackie & Son, Ltd., 50, Old Bailey, London, E.C.4.

COMMERCIAL and INDUSTRIAL NEWS

C. A. Parsons' Activities. Generating Plant for a Steel Works. Brush Company's Developments. Christmas Window Displays

Our Overseas Trade

THE Association of British Chambers of Commerce at its monthly meeting on December 6th adopted a resolution for the maintenance of overseas trade which has been submitted to the Prime Minister. It urges the Prime Minister to constitute a co-ordinating committee, consisting of the Ministers of the appropriate Government Departments, to evolve and carry out a trade policy to meet the conditions brought about by the war. The Association suggests that this committee should be presided over by a Minister for the Co-ordination of Trade specially appointed for the purpose, and with a seat in the War Cabinet. The Executive Council further urges that this co-ordinating committee should be assisted by an advisory committee on the lines of the Prime Minister's Industrial Panel, to be specially set up for this purpose, composed of persons experienced in trade and industry.



Parsons 50,000-kW, 3,000 RPM turbo-alternator at Bunnerong, N.S.W.

West Midlands J.E.A.

The Minister of Labour and National Service has given notice that as soon as may be after January 9th next he will designate to the West Midlands Joint Electricity Authority, in accordance with the West Midlands Electricity District Order, 1925, the employees' organisations having members in the employment of authorised undertakers in the district, in order that the organisations so designated may choose a representative of persons employed in connection with the supply of electricity in the district to be a member of the Joint Authority. Any employees' organisation which is desirous of being considered by the Minister for designation under the said Section should make application in writing to the Minister not later than January 6th on the form provided for the purpose, of which copies may be obtained from the Secretary, Ministry of Labour and National Service, Montagu House, Whitehall, London, S.W.1.

Trading With the Enemy

The Board of Trade has issued a further amendment (No. 3) to the Trading with the Enemy (Specified Persons Order) which gives the names of additional foreign agents of German concerns with whom commercial relations are forbidden. They include the following:—A.E.G. Electrotecnica A.G., Bogotà, Colombia; Bulgarian Tube Industry Co., Ltd., Sofia; "Elin" S.A. d'Industrie Electrique, Sofia; Mannesmann Rohrenwerke Dusseldorf, Osaka, Japan; Mannesmann, Tubos, Montevideo, Uruguay; Siemens Bau-union Ltda. (Philipp Holzman), Bogotà; Siemens Bau-union, Montevideo; Siemens & Halske A.G., Bogotà; Siemens-Schuckert A.G., Bogotà; Siemens Reiniger Werke (Dr. Hogelstein), Bogotà; Telefongyar Részvénytársaság (Telefonfabrik A.G.), Budapest; and Telefunken, Lima, Peru.

Entertaining Erith

That electrical showrooms have their uses even after the usual closing hours is apparent from an interesting programme sent us by Mr. E. A. Logan, electrical engineer to the Erith Corporation, of an entertainment which was recently given at Electricity House, Erith, by the "Anti-Dims" concert party, formed by the Erith A.R.P. personnel for the amusement of their colleagues. The programme was produced by Mr. R. Giles, sales engineer of Siemens Bros. & Co., Ltd., Woolwich, and appears to have been a great success. The theatre is proving very popular to judge from the number of bookings by the public, and as they cannot fail to be attracted by the electrical features of the premises, these bookings are no doubt proving beneficial to the electricity undertaking.

Atlas Shop Window Unit

Thorn Electrical Industries, Ltd., have introduced a new "Atlas" shop window lighting unit which effectively complies with the requirements of the Ministry of Home Security. It comprises a 25-W lamp, as specified, and a box shade deflector, designed to the Government specification. The complete unit, including lamp and deflector shade, is being marketed at a very low price.

C. A. Parsons' Activities

A notable feature of the output of C. A. Parsons & Co., Ltd., during 1939 has been the number of turbo-alternators either ordered for or put into commission abroad. The most interesting of these are probably the two sets for the Bunnerong power station of Sydney County Council, Australia, the first of which was recently erected. They are the first three-cylinder 50,000-kW 3,000-RPM machines to be constructed in this country. Another 50,000-kW set (1,500 RPM) is the fourth to be installed at the Dunston station of the N.E.S. Co.

Large 3,000-RPM machines are also represented by two 40,000-kW turbines with 33-kV alternators for Capetown. Alternators for the same voltage are components of two 30,000-kW sets for Calcutta and one for Newport A. (Victorian Railway Commissioners) and of 40,000-kW and 25,000-kW sets on order for the Congella station of the Electricity Supply Commission, South Africa, and for Brisbane. To meet normal load developments at Rotherham a 25,000-kW set (similar to that started up last March) and a 30,000-kW set are under construction. Turbo-alternators of 30,000 kW have also been installed at Hackney and Littlebrook and one of 20,000-kW has been supplied to the N.S.W. Railways.

Smaller machines, including those of the "Uniplane," back-pressure and pass-out types, ranging from 525 to 7,500 kW, have also been built for the home and Dominion markets. Outstanding among other products is a 1,500,000-kVA 22-, 11-, or 6.6-kV short-circuit testing alternator with super-excitation ordered by Reyrolle's, together with two banks of three 13,700-kVA, 11/38-kV single-phase shell-type transformers.

Among the contracts in hand in the transformer department is a repeat order for a 40,000-A furnace transformer and an order for two iron-cored reactors for use with other furnace transformers. Six current-limiting reactors to give 3 per cent. reactance in two three-phase 10,000-kVA 33-kV systems are in hand for Sydney County Council. There are also in hand a number of distribution transformers for South Africa and India and three 36,500-kVA, 33/11-kV transformers for the Mersey Power Co.

"Ediswan" Publicity

Many electrical concerns are striving to pursue a policy of "business as usual," and among them is the Edison Swan Electric Co., Ltd., which, in addition to its many other activities, is maintaining its window-dressing service as near to normal as possible. That dealers appreciate the continuance of this service is shown by the encouraging inquiries which are being received. With the approach of Christmas the company has prepared a special seasonal window-dressing display in which a number of useful suggestions for Christmas gifts are included.

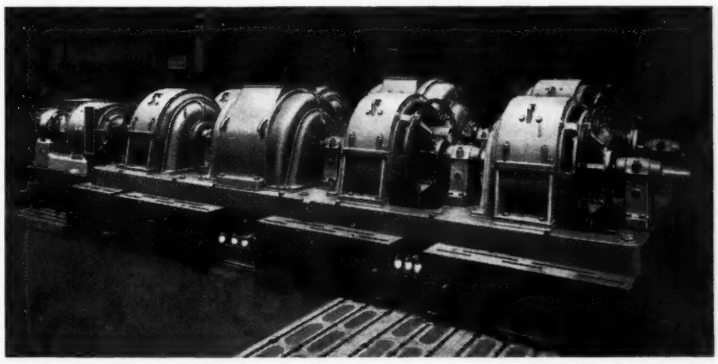
"Ediswan" Window Display for Christmas

The first of a series of musical concerts sponsored by the company was broadcast from the Radio International station on December 3rd. The concerts from this station are to provide "home atmosphere" for the British troops in France and are given between 7 a.m. and 8 p.m. The Edison Swan Co. has booked the broadcasts from 3.45 to 4 p.m. and from 6.15 to 6.30 p.m.

Generating Plant for a Large Steelworks

In connection with an important contract for electrical equipment now being undertaken by the General Electric Co., Ltd., for the new slabbing mill of John Summers & Sons, Ltd., two interesting motor-generator sets have been on test at Witton Engineering Works and are shown in the accompanying illustration. It will be seen that the equipment in the foreground includes six machines; a 700-HP, 6,600-V, 1,000-RPM synchronous motor is direct coupled to three 135-kW, 250-V DC generators and also to two exciters.

The smaller of the exciters, seen at the extreme left of the set, supplies the synchronous motor, while the larger exciter supplies the three DC generators of the set, the three corresponding generators of the second set, and certain other machines. The second motor generator set is identical with the first, except that it includes only one exciter—that for the synchronous motor; some of the machines of the second set can be seen over the top of those of the first.



G.E.C. synchronous motor-generators for a large steelworks on test at the company's Witton works

Swansea Electricians' Wages

A special meeting of the Swansea Borough Council on December 8th considered a claim made through the A.E.U. by the shift fitters at the Tir John power station for an increase of 2d. per hour, bringing their rate of pay up to 2s. per hour. The matter had been considered at several meetings of the Electricity Committee and 1½d. increase was offered. The men, however, stood out for the full 2d. and on the night of December 6th they ceased work. After a lengthy discussion the Council decided to concede the full claim of 2d. per hour and also agreed to certain other conditions of working that were in dispute.

Shop-Window Lighting

In connection with the Ministry of Home Security's announcement that a certain amount of lighting for shop-window display is now permitted as an experiment to help

Policemen at a Lighting Service Bureau demonstration of shop-window lighting

Christmas shopping, Scotland Yard has organised several visits to the Lighting Service Bureau to ensure that policemen shall be fully conversant with the new shop lighting, and in the accompanying picture we show members of the Force inspecting some of the demonstrations.

Electricity House, Ltd.

Electricity House, Ltd., which has been evacuated to the country, announces in our advertisement pages to-day that it is prepared to arrange meetings on the first and last Wednesdays of each month, with manufacturers' representatives in Leeds, to discuss the purchase of electrical apparatus. It is also prepared to consider retailing A.R.P. shop window lighting box type shields.

Brush Developments

A year of expansion in every branch is recorded by the Brush Electrical Engineering Co., Ltd. Orders in hand for Ljungström turbo-alternators for normal load developments include one of 37,500-kW for Swansea, one of 30,000-kW for Wolverhampton, two of 15,000-kW for Burton-on-Trent and one of 20,000-kW each for York and Sunderland. Acceptance tests have been carried out on a 15,000-kW set at Grimsby. The Swansea unit is of the same capacity as the two at Brighton, the second of which was put into service last summer. Other turbo-alternators constructed range from 900 kW for Mozambique to 15,000 kW for N.S.W. railways.

Motor-generators for electrolytic work are a further product of the company; those built have an output of 10,000 A at from 4 to 24 V, adjustable in steps not exceeding 0.1 V. Five 10,000-kVA portable self-cooled transformers with a ratio of 11/6.6 and 3.3 kV and two 7,000-kVA auto-transformers with a ratio of 6.6/5.35 and 2.5 kV are under construction for the Central Electricity Board for emergency use. On-load tap-changing gear has been introduced for fitting to transformers up to 33-kV and up to 40-A winding current.

In addition to its standard squirrel-cage and slip-ring machines the company has recently developed a range of controlled-torque AC motors of from ¼ to 50 HP. In the switchgear section there is a new series of 11-kV metal-clad sub-station units, incorporating oil circuit-breakers and spring-closing mechanism, which have been awarded the certificate of the British Short-Circuit Testing Station, Ltd. High- and low-voltage cubicle switchgear and kiosks, oil and air-break isolators, desk-type control boards, switchgear for small generating sets and liquid starters for motors are also being made at Loughborough in large quantities.

Transformers for New Zealand

Seven 7,400-kVA transformers are being supplied by the British Electric Transformer Co., Ltd., to the New Zealand Public Works Department. They are single-phase, 50-cycle, 11,000/63,500-V units and will be for outdoor service. Three will be used in a delta-star connected bank for stepping up the 11,000-V supply to 110,000 V. The transformers are of the water-cooled type with internal finned copper tube cooling coils. Tappings are provided on the l.v. windings and these are connected to an off-circuit tap switch which can be operated from ground level.

An Electric Iron Display Stand

Last month British Electric Domestic Appliances (1938), Ltd., placed upon the market the new "Mary Ann" double-way AC automatic electric iron which is available in three colours, cream, pastel green and powder blue. The company has now produced in colour a display stand for the use of "Mary Ann" dealers. Our picture shows the stand with one of these irons in position.

"Mary Ann" iron display stand

British Electric Domestic Appliances (1938), Ltd., informs us that it has been necessary to make further small increases as from January 1st in the prices of "Mary Ann" products. The company points out that it absorbed a great proportion of the increased costs of raw materials which arose shortly after the outbreak of war and advanced the prices by only 7½ per cent. The price of the "Mary Ann" double-way automatic iron, referred to above, is not affected by the new increases.

Household Electricity

Miss Caroline Haslett, Director of the Electrical Association for Women, has written a useful book entitled "Household Electricity" (English Universities Press, Ltd., Little Paul's House, Warwick Square, London, E.C.4. Price 2s. 6d.). After explaining simply and clearly how electricity is supplied

to a house and how the house is equipped to use the supply, Miss Haslett goes on to demonstrate how much can be done in the home with electrical appliances and how economical they are when properly used. Costs, the reading of meters, and the various tariffs in force are fully dealt with and there is an account of the functions, prices and running costs of every sort of appliance, so that the housewife can find out which type of apparatus best meets her particular needs, learn how it works, keep it in good condition, and use it without waste. The book is well illustrated and has an original feature in the index, which is arranged in the form of questions on the various topics dealt with in the book.

A.S.E.E. Lecture

The Association of Supervising Electrical Engineers has decided to hold a second lecture on December 19th at 6.30 p.m. at the Lighting Service Bureau when Mr. R. T. Lythall, A.M.I.E.E., will speak on "Low Voltage Switchgear."

Trolley-buses for Durban

In the article which appeared on page 941 of our last issue the photograph reproduced illustrated the "Metrovick" scissors-type of master controller and not the cab-mounted main switch-group as stated. The reference in the text to the contactors should have read "the contactors are of the electromagnetic type throughout and the contacts are all of pure silver."

G.E.C. and Hire-purchase

The General Electric Co., Ltd., announces the reintroduction of hire-purchase facilities for radio sets, refrigerators, cookers and household appliances. This step has been taken in order to exploit the full possibilities of development now that rationing of electricity seems unlikely to be imposed, and it is felt that it will be particularly helpful in assisting in making the most of Christmas trade. All dealers were advised of full details of the radio scheme in a booklet recently mailed to the trade. Registration forms were also distributed and traders were reminded that the extensive advertising campaign now being conducted would feature the availability of terms.

A letter stating that full particulars of a new hire-purchase plan was available for refrigerators was also mailed to all traders. Supply authorities and other trading concerns handling G.E.C. cookers have also been posted with details of a new scheme for hire purchase. It is felt that although in some areas hire and hire purchase have been curtailed or abandoned on account of financial restrictions, a public demand remains. The G.E.C. therefore seeks to aid authorities to increase their load by offering inducements to their customers which it is hoped will be appreciated by both.

The trade was also advised that extended payment facilities for household appliances were to be available to the public from December 7th. Full details of the arrangements for these appliances and cookers are contained in a folder (HA.8841).

To simplify sales and avoid confusion in the minds of the public unaccustomed to reckoning in percentages, the G.E.C. has issued revised price slips for insertion in its radio, household appliance, electric fires and refrigerator catalogues. These show the net list prices of all lines as at December 1st.

An Offer to the E.I.B.A.

The sum of one hundred guineas has been offered by a firm in the electrical industry, which must at present remain anonymous, as a contribution to the funds of the E.I.B.A., providing other firms will make special gifts of any sum, smaller or larger, to total up to a further three hundred guineas, with a view to making good the four hundred guineas loss of revenue which the Association has suffered by having to abandon its Grosvenor House Ball this year. It is hoped that cheques, small and large, will be sent so that the E.I.B.A. may quickly be able to claim the original hundred guineas.

Prices of Materials

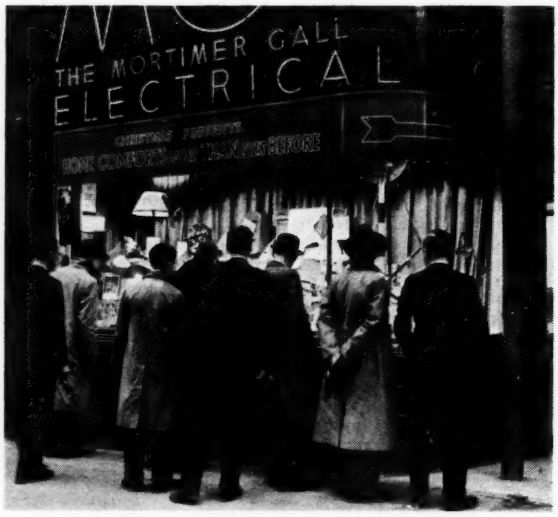
Edward Till & Co., report December 13th: India rubber, Para fine, 1s. 1d., 1d. increase.

Henry Gardner & Co., Ltd., report, December 13th: Copper bars (best selected) sheet and rod, English pig lead, mercury and spelter, no change. English block tin £271 10s., £41 10s. increase.

F. Smith & Co., report, December 13th: No change in the prices of electrolytic copper bars, wire rods and h.c. wires.

Christmas Window Display

Electrical firms generally do not pay nearly enough attention to the opportunity offered by Christmas for the sale of their goods. With the black-out and other restrictions imposed by the war, people are this year spending very much more of their time at home, and are especially likely to welcome those little extra comforts that electrical presents can provide. Congratulations are, therefore, due to Mortimer Gall & Co., Ltd., for their enterprise in arranging, at their premises in Cannon Street, London, E.C.4, a special display of just those appliances that are most appropriate as gifts. The articles chosen range in price from 5s. to 18 guineas, and include such up-to-date novelties as rubber torches and walking-sticks with torches in the ferrules. Shaving-mirrors, bowl fires, table lamps, telephone lights, decoration lamps, soldering irons, and sun-ray lamps are a few other suggestions, and special notice is drawn to the company's willingness to change any gift that proves unsuitable—an essential feature, owing to the possibility, for instance, of the voltage being wrong. The display has been arranged by Mr. S. Smith, the showroom manager. At night indications of the way in and the fact that the



Mortimer Gall Christmas window display

premises are open are given by means of fluorescent paint energised by a concealed black lamp. As another example of opportunism, the company is already supplying illuminated cabinets specially made to conform with the regulations issued last week for shop-window lighting.

Catalogues and Lists

Walker Brothers (Electrical Engineers), Ltd., Quality House, Temple Row, Birmingham.—An illustrated folder giving suggestions for electrical presents for Christmas.

Sears, Roebuck & Co., Ltd., Wembley.—A leaflet describing a special "Coldspot" refrigerator for A.R.P. purposes.

Simplex Electric Co., Ltd., Credenda Works, Oldbury.—A leaflet describing the new Creda "Warden" fire for A.R.P. and general purpose use.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Leaflets relating to four new types of valve.

R. F. Winder, Ltd., Belgrave Electrical Works, Leeds.—The December catalogue of surplus new and second-hand electrical material.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Publication 7783/1, the third edition of "Metrovick Electric Welding," which briefly describes the company's wide range of welding equipment and includes, in addition, illustrations of various welded products.

Dynamo & Motor Repairs, Ltd., Wembley Park Works, North End Road, Wembley.—An illustrated brochure outlining the company's advisory and repair service.

Bennie Lifts, Ltd., 2, Tinworth Street, Albert Embankment, London, S.E.11.—A leaflet describing the Crighton mechanical roof shutter (light obscuration) for which the company has been appointed manufacturing and selling agent. This shutter has been approved and accepted by the Air Ministry and the Ministry of Supply.

Manor Electric Oven & Fire Co., 175, Windsor House, Victoria Street, London, S.W.1.—A catalogue containing illustrated particulars of electrically heated food trolleys, hot cupboards, table heaters and heated tables.

Revo Electric Co., Ltd., Tipton, Staffs.—A leaflet dealing with the "Davlite" mask for traffic signals.

Partridge, Wilson & Co., Ltd., Davenset Works, Evington Valley Road, Leicester.—A pamphlet describing "Davenset" small transformers and battery chargers for simplified emergency lighting installations conforming to BS/ARP6.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Publication SF300, entitled "Sirocco Products for Dust Removal and Collection," which describes the range of "Sirocco" equipment for this purpose.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

LAGAN door switch.

SENATE torch (agents).

ELECTRICITY SUPPLY

Electric Kettles for Cardiff Wardens' Posts. Large Manchester Schemes. North West Midlands Power Station Site Chosen. Cost of Anthracite Duff for Tir John

Barrow-in-Furness.—SUPPLY TO FARM.—To provide a supply to Nether Close Farm, Ireleth, the Electricity Committee is to extend the mains at a cost of £122.

Blackburn.—SUPPLY SCHEMES.—The Electricity Committee has agreed to afford a supplementary supply of electricity to Philips Blackburn Works, Ltd., for the operation of an electric furnace; a general supply to Hartley Street Mill recently acquired by Oxo, Ltd.; and an increased supply the Oak Manufacturing Co.

Brighton.—HIGH-VOLTAGE SCHEME.—The Electricity Committee is to increase the capacity of the interlinking transformers between the 33- and 8-kV systems by the augmentation of inter-bus connections at a cost of £11,800.

FIRE PRECAUTIONS.—A sum of £1,025 is to be spent on extending the fire fighting equipment at the power station.

Burnley.—CHARGES RAISED.—To meet wartime conditions the Electricity Committee has increased the flat rate for lighting from 4¼d. to 4½d. per kWh, and that for heating and domestic purposes, business premises and shops from ¾d. to 1d. Under the "all-in" rateable value system the "unit" charge of ½d. remains unchanged, but there is a 5 per cent. addition to the fixed charge. For lock-up shops the kW charge remains as at present, with 0.6d. instead of 0.5d. per kWh. Increases also apply to industrial power, the new scale being 1¾d./1d.

Cardiff.—ELECTRIC KETTLES FOR WARDENS' POSTS.—When the A.R.P. Committee met last week the chief constable reported on the desirability of providing electric kettles at wardens' posts. He submitted an offer from the city electrical engineer to supply 81 kettles at the cost of reconditioning only, namely, £24 10s. This price would apply provided the kettles were returned when they were no longer required and any not returned would be charged for at 10s. each. Installation would be carried out by the Electricity Department without charge. The offer was accepted.

Carlisle.—PROPOSED SUB-STATION.—The Electricity Committee has obtained a site in Richardson Road for the erection of a sub-station.

Chesterfield.—LIGHTING IN SHELTERS.—The Emergency Committee is to provide electric lighting at shelters at a cost of £637.

Chester.—SUB-STATION.—The Electricity Committee has purchased a site in Pearl Lane for a sub-station.

Coventry.—LOAN FOR MAINS EXTENSIONS.—The Corporation is recommended to apply for sanction to borrow £3,009 for extensions to the electricity mains.

Dumfries.—SUPPLY TO ESTATE.—At its last meeting the Town Council adopted a recommendation of the Electricity Committee proposing an expenditure of £2,000 on an electricity supply to a housing estate, and instructing the manager to restrict the present facilities for hire of domestic appliances and hire-purchase wiring with a view to avoiding capital expenditure for this purpose.

Great Yarmouth.—ENGINEER'S REPORT.—Many undertakings suffered a deterioration in load factor through last year's "cold spell," but Mr. P. E. Rycroft is able to report that at Yarmouth the ratio between output and maximum demand was satisfactorily maintained during 1938-39, with a load factor of 36.84 per cent. compared with 36.25 per cent. in the previous year. Active development occurred both in the borough and rural area, supplies in the former rising by 16 per cent. to 23.3 million kWh, while in the rural area sales increased by 18 per cent. to 5.5 million kWh. To meet the heavy demand for domestic supplies and to ensure an adequate voltage at feeding points, 24 miles of underground cable was laid to replace and augment existing mains. In addition, 13 miles of overhead lines were erected. Indicative of the steady and continuous demand for domestic appliances during the period is the fact that rentals increased from £6,849 in 1937-38 to £8,279 last year. The income of the Department was £192,160 (against £186,049) and working expenses were £122,410 (£106,789), with a net profit of £10,403 (£24,240).

10 PER CENT. PRICE INCREASE.—Electricity is to cost more as from the reading of meters for the December quarter, when all electricity accounts will be subject to a general addition of 10 per cent. The small consumer might have to pay 1½d. or 2d. a week extra, stated Mr. W. G. Knights, chairman of the Electricity Committee, in announcing the increase last week. The length of service cable laid free to premises of new consumers and the wiring to new consumers for domestic apparatus will be reduced from 60 ft. to 30 ft.

Grimsby.—PRICE INCREASE.—In the New Year there is to be a 10 per cent. increase in electricity charges, with a review of the position after a month's working. It is estimated that the increase will provide an additional £1,500 during the coming year, but will not balance the estimated deficit for 1940-41. Electricity prices have been kept down by the undertaking for several years, in spite of rising costs.

Hove.—HIGHER SUMMER CHARGE.—It is proposed to make the "unit" charge under the domestic and business tariffs ½d. all the year round. At present the charge is ¼d. for the two summer quarters.

Kendal.—PROFIT ON UNDERTAKING.—It was reported to the Council on December 5th that the Electricity Department had made a net profit of £2,783 during the year ended March 31st last.

London.—SOUTHWARK.—The Electricity Committee is seeking sanction to borrow £10,000 for assisted wiring and £3,000 for apparatus for hire.

Macclesfield.—JOINT METER READINGS.—The Corporation, which is now operating the undertaking formerly controlled by the Electricity Co., of Macclesfield, Ltd., and also owns the gas undertaking, has approved in principle of arrangements being made for a system of joint readings of gas and electricity meters and prepayment cash collections. Separate accounts are, however, to be rendered in respect of each undertaking. The present practice of allowing the supply of electricity and fittings at reduced prices to 51 employees of the electricity undertaking is being discontinued.

Manchester.—EXTENSIVE SCHEMES.—There has just been presented to the Manchester City Council a summary of the schemes of the Electricity Department involving a total expenditure of £1,450,081, in respect of which it is proposed to seek permission for them to be proceeded with. The amount falling due to be paid with the current municipal year is £146,247; next year, £518,945; and subsequently £542,420. The balance not required for the present is £242,469. Details are: plant for Stuart Street generating station, £18,336; plant for Barton station, £21,804; buildings at Barton, £4,986; plant at Stuart Street (under consideration of Commissioners), £892,420; distributing station equipment £43,019; distributing station buildings, £15,509; transformer station equipment (control room), £29,924; distributors, £208,647; feeders, £47,251; services, £103,319; street lighting, £12,591; fire precautions, £11,685; extension of Greenwood sub-station, £20,450; transformer station equipment (Droylsden East), £4,150; and 30-kV feeder, Stuart Street to Droylsden, £16,000.

(*Continued on next page.*)

New Street Lighting Installations

SEVERAL street lighting installations in Scotland have been recently completed by the British Thomson-Houston Co. The schemes were planned before the declaration of war and despite the subsequent black-out regulations the local authorities decided to proceed with the work.

At Leslie (Fife) a comprehensive electric street lighting system covering the entire burgh has been finished, all gas lighting being superseded. For the main road lighting 32 "Mercra" electric-discharge lamps have been installed and are housed in B.T.H. "County Junior" lanterns mounted on columns at a height of 25 ft. In side streets 100-W "Mazda" gas-filled lamps are used.

The new street lighting installation at Ladybank, Fife, also employs "Mercra" and "Mazda" lamps. The installation covers the whole burgh and will bring the street lighting up to a very high standard when normal lighting is again permitted.

At Strathmiglo the company has completed a street lighting installation employing gas-filled lamps and covering all main and side roads throughout the town.

In addition to completed B.T.H. installations at Motherwell and Wishaw the Electricity Department has recently tried out an experimental street installation using "Mercra" ultra-violet lamps in conjunction with fluorescent powders and paints. The units were mounted on existing standards with 16 ft. and 25 ft. mounting heights. Kerb lines, centre road lines, posts, direction signs and "obstructions" were coated with fluorescent paint which, subjected to ultra-violet rays, produced visible radiation on the treated surfaces. This fluorescence enabled both motorists and pedestrians to move about with greater safety. The installation met with the approbation of the members of the Councils present at the demonstration. The normal street lighting employs standard "Mercra" lamps and it was only necessary for the purpose of the demonstration to substitute "Mercra" ultra-violet lamps and special reflectors for the existing lamps and lanterns.

North-West Midlands.—SITE FOR POWER STATION.—In July last the Electricity Commissioners concluded an inquiry into the J.E.A.'s application for permission to construct a power station at Barlaston (ELECTRICAL REVIEW, July 14th, p. 64). There was considerable opposition to the erection of a power station on the suggested site, and the scheme was rejected by the Commissioners. A comprehensive survey was therefore undertaken by the J.E.A. to discover a suitable alternative site for the proposed station, and in our issue of August 4th we reported that a place known as Newstead, on the Trentham-Longton Road, was under consideration. It is now reported that the Authority is to acquire 100 acres at Newstead Farm.

Rawtenstall.—EXPERIMENTAL STREET LIGHTING.—Authority is to be sought for a test of a new street lighting system devised by Mr. V. Hewitt, Corporation lighting superintendent. An adaptation of the ordinary "Wembley" lanterns with 20-W lamps, the system includes discs which cut off the direct rays. White circular discs diffuse illumination for a radius of 20 yards. The light is sufficient for people to walk comfortably about and will not affect road traffic. The lamp is scarcely visible 80 yards away and from above it is stated to be invisible.

Sheffield.—EFFECT OF WAR CONDITIONS.—Councillor J. Whittington, chairman of the Electricity Committee, informed the City Council last week that the Committee was budgeting for a deficit of £21,594 for the year ending March, 1941, but there was no question of the undertaking not being able to deal with any reasonable deficit by financial means within the undertaking. There was going to be a considerable loss of revenue during the next financial year, and lighting and other restrictions were expected to account for £47,000 of it. Additional costs were estimated to amount to £214,923. The Committee had to meet during the two years 1939 and 1940 an additional total expenditure of £378,818, of which £311,145 was directly due to war conditions. It was not considered that it would be necessary to make any increases in tariffs during the present financial year, but it was possible that a small war increase might have to be imposed during the next financial year.

Swansea.—ARRANGEMENTS WITH C.E.B.—The electrical engineer and manager, Mr. H. E. Blackiston, has reported upon the basis on which, from January 1st, the Swansea undertaking will buy back from the Central Electricity Board its own requirements of electricity. The negotiations, he said, were proceeding satisfactorily. As, since the completion of the Tir John power station, the Corporation had been bearing capital costs in excess of those for a station for its own purposes, a reserve fund which stood at £77,000 in 1936 had been used and there was now a revenue suspense account of £33,710. As from January 1st the Board would pay all capital charges and running costs and would pay the Corporation 2s. 3d. per annum for each kilowatt of installed generating plant as a management fee. The basis on which the Corporation would buy back from the Board its whole requirements of electricity would entail many very intricate calculations on which the borough treasurer and himself were co-operating. Negotiations were proceeding and it was believed that a satisfactory arrangement for the first five years would be arrived at. Because of major alterations and extensions to the plant it was difficult at the moment to give as close an estimate of the cost of the energy to be purchased as they would have been able to do had the station run completely satisfactorily from the first. The report has been approved.

COST OF DUFF.—Amalgamated Anthracite Collieries, Ltd., recently intimated that it proposed to increase its price for duff for Tir John power station under the terms of the Order of the Secretary for Mines, raising the price of coal in consequence of increased costs of production. The Town Clerk has, however, given his opinion against such an increase in view of the terms of the contract with the company for a 20 years' supply made in 1933.

TRACTION

Brazil.—NEW ELECTRIC LOCOMOTIVES.—Four DC locomotives for the Paulista Railway, in Brazil, are nearing completion at the American General Electric works, at Schenectady, and will be delivered early in the new year, reports *Reuter's Trade Service*. The locomotives weigh 185 tons each and will have a maximum speed of 93 miles an hour. They have a continuous rating of about 4,200 HP.

Norway.—REPORT ON RAILWAY ELECTRIFICATION.—The Road and Railway Committee appointed by Parliament has completed its report on the electrification of the State Railways, learns *Reuter's Trade Service* from Oslo. A majority of the Committee propose that the electrification of the Nordagutu-Neslandsvatn line should be put in hand, and that further schemes should be carried out in the following order: (1) The Lillestroem-Riksgrensen (frontier) section of the Kongvinger line; (2) the Neslandsvatn-Kristiansand section of the Soerlands line; and (3) the Lillestroem-Hamar section of the Dovre line.

Portugal.—NEW TRAMS.—A series of new tramcars of smart appearance is being brought into service by the Lisbon Electric Tramways Co., states *Modern Transport*. The bodies are mounted on two Maley and Taunton equal-wheel bogie trucks, each of which is fitted with a pair of 25-HP, 225-V "Metrovick" motors, connected permanently in series. The car thus has 100 HP available for rapid acceleration and climbing the severe gradients met with in Lisbon, which also necessitate braking equipment of the very highest order. The trams, which are 38 ft. long, are designed to seat 36 passengers in well-designed and commodious rattan seats. Special attention has been paid to ventilation and lighting, the latter being shadowless and more than adequate for normal needs.

A new electric vehicle which has recently been put into service by the Bridlington Corporation Electricity Department

COMMUNICATIONS

Australia.—PRIME MINISTER TO INAUGURATE SHORT-WAVE SERVICE.—Sir Henry Gullett, Commonwealth Minister for External Affairs, announced last week that Mr. R. G. Menzies, the Prime Minister, would inaugurate a world wide Australian short-wave broadcast service on December 20th. Mr. Menzies' talk would be given at a time at which it could be heard in Northern Europe early in the morning. It would be translated into German, French, Dutch and Spanish, and would be re-broadcast at other times on the same day in other transmissions. When complete the service would cover Europe, North and South America, the East, India and Africa. —*Reuter*.

Great Britain.—MORE RADIO RELAY SUBSCRIBERS.—At September 30th there were 259,657 radio relay subscribers compared with 254,514 at June 30th, the percentage of subscribers' licences to the total receiving licences in force rising from 2.82 to 2.86. The number of exchanges remained at 323.

Black-out Street Lighting

OFFICIAL permission is being sought by Mr. W. A. Turner, borough electrical engineer, Southampton, to light experimentally a street by a low-intensity illuminating system which has been devised by him in association with Mr. C. A. Child, of his staff.

According to the *Southern Daily Echo* the equipment comprises a projector unit of multiple horizontal cells which emit fan-shaped beams possessing definite and predetermined optical limits. It is proposed to fix the lamps on diagonally disposed standards just above head level in such a way that the light will be deflected across and over the highway and opposite footpath, the maximum illumination falling on moving objects. Ribbed vanes in the projector form an anti-glare surface and prevent extraneous diffusion of light.

On his return last week to Glasgow from London, where he had been conferring with Home Office officials, Bailie R. Y. Gemmell, chairman of the Corporation Lighting Committee, stated that a modified system of street lighting would be in operation in Glasgow by the middle of January. At the invitation of the Home Office officials he, together with the chief constable and the inspector of lighting, had visited a demonstration of modified lighting in the Edgware Road district of London. Members of the deputation, he said, considered that the lighting experiment was extremely satisfactory, and they were informed by the Home Office officials that they could go ahead with similar lighting, as it had the approval of the Government for adoption throughout the country. The Glasgow lighting system comprised over 21,000 electric street lamps and 14,500 gas lamps, and the inspector of lighting had been instructed to proceed with the work of installing the new fittings. Preference was to be given to main thoroughfares, and it was confidently expected that these would be lighted by the middle of January. While the lighting would be modified, every lamp in the city would be lighted.

The Home Office, however, stated that aerial observation of the street-lighting experiment which the authorities were conducting had not yet been completed, and that consequently no decision upon it had yet been reached. According to the *Scotsman*, Bailie Gemmell said he could not understand the Home Office denial.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

3204. "Ignition-timing mechanism for supercharged internal combustion engines." F. H. Arnott. February 2nd, 1938. (514670.)

6694. "Magneto generators." Bendix Aviation Corporation. March 6th, 1937. (514674.)

7871. "Superheterodyne wireless receivers." Marconi's Wireless Telegraph Co., Ltd. March 13th, 1937. (514723.)

9738. "Multi-anode gas-filled electric-discharge tubes." Soc. Anon. pour les Applications de l'Electricité et des Gaz Rares Etablissements C. Paz & Silva. February 2nd, 1938. (514676.)

10562. "Service meter-reading equipment for use in telecommunication systems." Standard Telephones & Cables, Ltd. (L. J. J. Schreiber). April 6th, 1938. (514775.)

11040. "Alternating electric current induction apparatus including an electromagnet having a shaded pole." General Electric Co., Ltd., and F. G. Rowland. April 11th, 1938. (514724.)

11041. "Positioning means for apparatus, particularly electric relay apparatus, having members arranged to occupy any one of a plurality of positions." General Electric Co., Ltd., and F. G. Rowland. April 11th, 1938. (514679.)

11198. "Natural colour television systems." Scophony, Ltd., and A. H. Rosenthal. April 12th, 1938. (514776.)

11280. "Protective devices in connection with high-voltage electrical discharge apparatus." E. L. C. White and A. D. Blumlein. April 13th, 1938. (514825.)

11416. "Machines for welding and forging metals." E. Gaspar Omes, Ltd. April 13th, 1938. (514727.)

11572. "Negative resistance circuit arrangements." Marconi's Wireless Telegraph Co., Ltd., N. M. Rust and J. D. Brailsford. April 14th, 1938. (514685.)

12637. "Electric forging and apparatus therefor." E. Gaspar and Omes, Ltd. April 27th, 1938. (514728.)

12661. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd. April 28th, 1937. (514686.)

13636. "Thermionic valve amplifiers." C. G. Mayo and H. D. M. Ellis. May 6th, 1938. (514729.)

13838. "Radio signalling systems." British Thomson-Houston Co., Ltd. May 7th, 1937. (514778.)

13859. "Gear-changing arrangements for electricity meters or the like." Sangamo Weston, Ltd., and G. E. Weston. May 9th, 1938. (514779.)

14078. "Image-suppression system for wireless receivers." Johnson Laboratories, Inc. May 17th, 1937. (514640.)

14079. "High-frequency signalling systems." Johnson Laboratories, Inc. May 17th, 1937. (514641.)

14082. "Television and like systems." Baird Television, Ltd., and P. W. Willans. May 11th, 1938. (514643.)

14146. "Current-collectors for trolley-buses or the like vehicles." F. Szalay. February 28th, 1938. (514647.)

14169. "Production of luminescent screens." Franco-British Electrical Co., Ltd., and A. H. Brackensey. May 12th, 1938. (514649.)

14184. "Television or like systems." Fernseh Akt.-Ges. May 12th, 1937. (514650.)

14188. "Air-cooled thermionic valves." M-O Valve Co., Ltd., D. A. Bovland and R. Le Rossignol. May 12th, 1938. (514651.)

14206. "Thermionic cathodes for electric-discharge devices." British Thomson-Houston Co., Ltd. May 14th, 1937. (514654.)

14209. "Methods of and apparatus for manufacturing incandescent electric lamps and similar articles." May 15th, 1937. (514732.)

14221. "Automatic switches for use in telephone or like systems." Automatic Telephone & Electric Company, Ltd., and O. J. Cheshire. May 12th, 1938. (514658.)

14273. "Electric disconnecting links." G. P. Cosway and C. A. Hazeltine. May 13th, 1938. (514697.)

14308. "Signalling systems." Telefonaktiebolaget L. M. Ericsson. May 13th, 1937. (514701.)

14322. "Electric liquid-break circuit-breakers." General Electric Co., Ltd., and C. J. O. Garrard. May 13th, 1938. (514704.)

14327. "Apparatus for electric seam welding." H. Trunkwalter. May 13th, 1937. (514705.)

14336. "Electric relays." Westinghouse Brake & Signal Co., Ltd., D. G. Shipp and T. C. Yeo. May 13th, 1938. (514709.)

14355. "Thermionic valve amplifying systems." Standard Telephones & Cables, Ltd., A. H. Roche and S. J. Goullee. May 13th, 1938. (514713.)

14356. "Electric-discharge devices." Standard Telephones & Cables, Ltd., and W. T. Gibson. May 13th, 1938. (514735.)

14370. "Automatic switches for use in telephone or like systems." Automatic Telephone & Electric Company, Ltd., and G. T. Baker. May 13th, 1939. (514737.)

14375. "Vacuum electric tube devices." J. M. Dodds, J. H. Ludlow, and Metropolitan-Vickers Electric Co., Ltd. May 13th, 1938. (514738.)

14413. "Electric lighting fittings." Veritys, Ltd., and J. W. Forth. May 14th, 1938. (514745.)

14438. "Electrical resistors." Erie Resistor, Ltd., A. O. Henton and A. F. Drewett. May 14th, 1938. (514750.)

14443. "Manufacture of alternating-current rectifiers of the dry surface-contact type." Westinghouse Brake & Signal Company, Ltd., A. L. Williams and L. E. Thompson. May 14th, 1938. (514751.)

14448. "Time switches." British Thomson-Houston Co., Ltd. May 15th, 1937. (514716.)

14470. "Electrical heating-apparatus." C. R. Belling & Co., Ltd. May 14th, 1938. (514782.)

14490. Miners' electric lamps." Concordia Electric Safety Lamp Co., Ltd., and J. W. Jones. May 14th, 1938. (514755.)

14504. "Rubber-like compositions." Craigpark Electric Cable Co., Ltd., and J. R. M. Duncan. May 16th, 1938. (514785.)

14552. "Electric motor control systems." English Electric Co., Ltd., and H. S. Pound-Corner. May 16th, 1938. (514789.)

14605. "Circuit arrangements for deriving a voltage which is independent of fluctuations of the supply voltage." Siemens & Halske Akt.-Ges. May 15th, 1937. (514800.)

14631. "Voltage control devices for electric supply systems." E. L. C. White. May 17th, 1938. (514835.)

14637. "Electric tumbler switches." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. May 17th, 1938. (514836.)

14656. "Electro-magnetic switch mechanism." J. B. Tannahill, W. A. B. Ames and W. E. Lawley. May 17th, 1938. (514841.)

14690. "Oxide-coated cathodes and their manufacture." General Electric Co., Ltd., and M. Benjamin. May 17th, 1938. (514849.)

14694. "Manufacture of insulated electrical leads." I. G. Farbenindustrie Akt.-Ges. June 25th, 1937. (514851.)

14706. "Telegraph systems." Creed & Co., Ltd., A. E. Thompson and R. D. Salmon. May 17th, 1938. (514853.)

14707. "Electron-discharge devices and thermionic cathodes therefor." Standard Telephones & Cables, Ltd., and H. Wolfson. May 17th, 1938. (514854.)

14759. "Electric insulators." Brown, Boveri & Cie. Akt.-Ges. February 19th, 1938. (514862.)

14904. "Electric protective arrangements." E. A. Fowler, L. Hyman & W. E. Oughton. May 19th, 1938. (Cognate application 14905/38.) (514863.)

16544. "Electric-discharge devices." M-O Valve Co., Ltd., and D. A. Rankin. June 2nd, 1938. (514758.)

16558. "Electric gas blast switches." British Thomson-Houston Co., Ltd. June 5th, 1937. (51759.)

16565. "Electrical musical instruments." A. H. Midgley and A. M. Midgley. June 2nd, 1938. (514760.)

16630. "Thermionic amplifiers." Ferranti, Ltd., and G. M. Tomlin. June 3rd, 1938. (514762.)

16676. "Electrical switchgear." English Electric Co., Ltd., and A. R. Blandford. June 3rd, 1938. (Cognate application 2905/39.) (514804.)

16707. "Apparatus for receiving television and like signals." General Electric Co., Ltd., E. C. Cherry, G. W. Edwards and B. J. O'Kane. June 3rd, 1938. (514807.)

16925. "Cathode-ray apparatus for the reproduction of luminous images." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 9th, 1937. (514809.)

17058. "Electrical signalling systems." Automatic Telephone & Electric Co., Ltd., and P. N. Roseby. June 8th, 1938. (514813.)

17067. "Electric cooking ovens." British Thomson-Houston Company, Ltd., and R. S. Gilling. June 8th, 1938. (514814.)

17191. "Directional saturable reactors." British Thomson-Houston Co., Ltd., A. L. Whiteley and L. E. Ludbrook. June 9th, 1938. (514865.)

TRADE MARK APPLICATION

THE following are among the recent applications for British trade marks.

Objections against any of the proposed marks may be entered within one month from December 6th:—

Mazdalux. No. 609584. Class I (IV). Activated zinc and zinc cadmium sulphides in powder form for use in making paints, varnishes and lacquers.—The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C.2.

Micromatic. No. 609378. Class 8 (IV). Electrical instruments for shaving or for removing hair from the face and body, and parts of such machines.—Ever Ready Razor Products, Ltd., Ever-Ready Corner, The Hyde, London, N.W.9.

Bio. No. 605209. Class 9 (IV). Alternating current rectifiers, coils for electromagnetic machines, electric fire alarms, circuit-breakers, circuit closers, electric connections, contacts, control apparatus, current limiters, cut-outs, saucepans, coffee percolators, kettles, resistances, flat irons, soldering irons, switches, leakage indicators and terminals, thermo-electric elements, electric relays, transformers and electro-magnets, &c.—Bio Electrics, Ltd., 18, Gibson Street, Glasgow, W.2.

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Martin's (Edmonton), Ltd.—Private company. Registered December 7th. Capital, £100. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in wireless receiving and transmitting apparatus, furniture, musical instruments, sports goods, electrical fittings, &c. Directors: F. Harris and Mrs. A. Harris, both of 44, Preston Drive, Wanstead, E.11. Registered office: 373, High Street North, Manor Park, E.12.

Engineering and Maintenance Supplies Co., Ltd.—Private company. Registered December 7th. Capital, £1,000. Objects: To acquire the business of wholesale electrical suppliers carried on by G. W. Parsons and H. J. Forrest at 96, Bloom Street, Manchester, as Engineering & Maintenance Supplies Co. Permanent directors: G. W. Parsons, 9, Hazel Drive, Brook Road, Heald Green, Ches; and H. J. Forrest, 69, Parsonage Road, Heaton Moor, near Stockport.

Midland Electric Wire Co. (1939), Ltd.—Private company. Registered December 7th. Nominal capital, £2 in two shares of £1 each. Objects: To carry on the business of electric cable and insulated wire manufacturers, manufacturers of and dealers in wires, cables and lines of all kinds, electricians, mechanical engineers, &c. Subscribers: A. N. Denaro, 4, Kingsdale Road, Liverpool, 18: and A. V. Tyrer, 8, Rosebery Avenue, Waterloo, Liverpool. Solicitors: Hill, Dickinson & Co., 10, Water Street, Liverpool.

Universal Hardware, Ltd. — Private company. Registered December 6th. Capital, £500. Objects: To carry on the business of manufacturers of, agents for and dealers in all kinds of electrical, lighting and heating appliances, apparatus and parts, lamp shades, domestic and other hardware, radio and television instruments, &c. H. Wynbourne, 26, Dobree Avenue, N.W.10, is the first director. Registered office: 54, Linthorpe Road, N.16.

Instrument Erectors, Ltd. — Private company. Registered December 4th. Capital, £100. Objects: To carry on the business of manufacturers and/or vendors of mechanical and/or electrical recording or indicating or integrating apparatuses, &c. Directors: T. H. Beckett, 236, Perry Wood Road, Great Barr-Birmingham, and D. W. James, "Westfield," Walmley Road, Erdington, Birmingham. Registered office: 43, Cannon Street, Birmingham.

Companies' Returns

Statements of Capital

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £37,550 19s. in 46,173 "A" shares of 10s. and 41,327 "A" shares of 7s. Return dated October 13th. 41,327 shares of 7s. taken up. £7,656 12s. paid (3s. 6d. on 41,327 shares, plus £424 7s. 6d. paid on 970 shares of 10s. forfeited). £7,232 4s. 6d. considered as paid (3s. 6d. on 41,327 shares). Mortgages and charges nil.

Barsi Light Railway Co., Ltd.—Capital, £800,000 in 4,000 ordinary shares of £10, £730,320 ordinary stock and £29,680 preference stock. Return dated October 17th. All stock taken up. £760,000 paid. Mortgages and charges: £140,000 4 per cent. debenture stock, £95,700 4 per cent. "Latus Extension" debentures, and £60,000 5½ per cent. debenture stock.

Ellis & Ward, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1. Return dated October 19th. 1,000 preference and 6,003 ordinary shares taken up. £1,003 paid on 1,000 preference and 3 ordinary shares, £6,000 considered as paid on 6,000 ordinary shares. Mortgages and charges nil.

Sterling Electric Holdings, Ltd.—Capital, £300,000 in 200,000 6½ per cent. cum. preference shares of £1 and 2,000,000 ordinary shares of 1s. Return dated October 23rd. 200,000 preference and 1,200,000 ordinary shares taken up. £254,000 paid (£1 on 90,000 preference, £1 1s. 6d. on 10,000 preference, £1 1s. on 50,000 preference, £1 2s. 6d. on 50,000 preference, 1s. on 265,000 ordinary, 2s. 6d. on 10,000 ordinary and 3s. on 200,000 ordinary). £36,250 considered as paid on 725,000 ordinary shares. Mortgages and charges nil.

Milton & Barton-on-Sea (Hants) Electricity Supply Co., Ltd.—Capital, £25,000 in 5,000 7½ per cent. cumulative preference and 20,000 ordinary shares of £1 each. Return dated April 11th (filed July 21st). All shares taken up. £24,227 paid on 5,000 preference and 19,227 ordinary shares, £773 considered as paid on 773 ordinary shares. Mortgages and charges, nil.

Sudan Light & Power Co., Ltd.—Capital, £500,000 in 94,000 preference and 406,000 ordinary shares of £1. Return dated June 26th. 52,000 preference and 406,000 ordinary shares taken up. £433,000 paid (£1 on 52,000 preference and 356,000 ordinary and 10s. on 50,000 ordinary shares). Mortgages and charges: £400,000.

Electric Construction Co., Ltd.—Capital. £400,000 in 100,000 preference and 300,000 ordinary shares of £1. Return dated June 30th. All shares taken up. £153,710 paid on 73,710 preference and 80,000 ordinary shares. £246,290 considered as paid on 26,290 preference and 220,000 ordinary shares. Mortgages and charges, £112,960.

Bush Radio, Ltd.—Capital, £80,000 in 320,000 shares of 5s. Return dated October 24th. All shares taken up. £80,000 paid. Mortgages and charges, nil.

John Adams, Ltd.—Capital, £7,000 in 6,000 preference and 1,000 ordinary shares of £1. Return dated October 24th. 2,700 preference and 300 ordinary shares taken up. £3,000 paid. Mortgages and charges, nil.

Ferranti, Ltd.—Capital, £900,000 in £400,000 ordinary stock (10s. units) and £500,000 7 per cent. cumulative preference stock (£1 units). Return dated November 8th, 1939. £300,000 ordinary stock and £500,000 preference stock taken up. £353,834 paid on £353,834 preference stock, £446,166 considered as paid on £146,166 preference stock and £300,000 ordinary stock. Mortgages and charges nil.

Mortgages and Charges

Tilley Brothers, Ltd.—Satisfaction to the extent of £1,500 on November 24th, 1939, of debentures authorised March 11th, 1925, and registered March 13th, 1925, securing £2,500.

Cecil Newling, Ltd.—Satisfaction in full on November 15th, 1939, of debenture dated April 6th, 1939, and registered April 11th, 1939. (According to the register of mortgages, the debenture registered April 11th, 1939, originally secured all moneys due to bank.)

Solectric, Ltd.—Debenture, charged on the company's undertaking and property, including uncalled capital, dated November 14th, 1939, to secure £5,000. Holder: Mrs. A. Sobel, "Stocks," Cranley Avenue, Rottingdean.

Davey, Paxman & Co. (Colchester), Ltd.—Issue on October 25th, 1939, of £25,000 debenture stock, part of a series already registered.

B. J. Legg (Industries), Ltd.—Particulars filed of debentures not exceeding £2,000, authorised October 25th, 1939, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,100.

Private Arrangement

F. E. Kerr, wireless dealer, 2, Manor Road, Hull.—At a recent meeting of the creditors a statement of affairs was presented showing liabilities of £374. The net assets were £255, leaving a deficiency of £118. It was decided that the matter should be dealt with under a deed of assignment already executed in favour of Mr. W. B. Hall, of Buckley, Hall, Devin & Co., Silver Street, Hull, whilst a committee was also appointed.

Company Liquidations

Fenemore, Howlett & Co., Ltd., electrical engineers and wireless dealers, 51, St. Leonards Road, Windsor.—Observations relating to the affairs of this company have been issued by the Official Receiver in the Companies Winding Up Department of the Board of Trade. The statement of affairs filed in the proceedings shows liabilities expected to rank amounting to £2,278 and net assets expected to realise £1,422. The Official Receiver states that the company was formed in January, 1931, with a nominal capital of £1,000. Accounts showed that in 1937 there was a trading loss of £137, and in the following year a further loss of £904. Early in 1939 defalcations occurred in the company's accounts of about £300. An employee was convicted, but no money was recovered by the company. The failure was attributed to that theft, to decline in turnover since 1936 and other causes. As a result of meetings of creditors and shareholders held in July last the Court appointed Mr. C. Latham, accountant, of London, as liquidator of the company, with a committee of inspection.

Fryers, Ltd.—Winding up voluntarily. Liquidator, Mr. L. Civval, Ling House, Dominion Street, Moorgate, London, E.C. This notice is purely formal as all creditors have been or will be paid in full.

Wetherill (Radio), Ltd.—Particulars of claims by February 14th to the liquidator, Mr. C. Green, 1, Fennel Street, Manchester.

J. F. Garrod, Ltd.—Particulars of claims by December 30th to the liquidator, Mr. R. H. Porter, 90, Gresham House, 24, Old Broad Street, London, E.C.2.

Erewash Electric Wire Co., Ltd.—Meeting January 12th at 24, Walbrook, London, E.C.4, to receive an account of the winding up by the liquidator, Mr. H. L. Smith.

Bankruptcy Proceedings

F. W. Ames, 73, Havelock Road, Bognor Regis, and lately carrying on business at 20, Longford Road, Bognor Regis, electrical engineer.—The public examination was resumed recently at the Court House, Church Street, Brighton. Debtor said he did not understand book-keeping, and had been unable to complete his accounts as required. His statement of affairs showed ranking liabilities of £334 and assets of 10s. 6d. The examination was adjourned for closing.

F. F. C. King, radio trader, 235, Banbury Road and other addresses, Oxford.—Last day for receiving proofs for dividend December 22nd. Trustees, Mr. J R. Pigott, 1-5, Broad Street, Oxford, and Mr. C. Latham, 185-188, High Holborn, London, W.C.1.

F. Arrowsmith, radio dealer, 34, Great Moor Street, Bolton, and at Bury, Blackburn and Accrington.—Trustees, Mr. A. O. Miles, 76, Cross Street, Manchester, and Mr. A. T. Eaves, 47, Mosley Street, Manchester, released November 28th.

J. R. C. August, electrical engineer, 9, Downsview Road, Upper Norwood, Croydon.—Trustee, Mr. H. W. Sydenham, 1 and 2, Trump Street, King Street, London, E.C.2, released September 2nd.

Reports and Dividends

Electric & Musical Industries, Ltd., held its annual meeting on December 6th when Mr. A. Clark (chairman), who presided, said that in view of the international disturbances it was not surprising that the public at home was not in a buying mood and that foreign markets equally were feeling the blighting effects of the war. The sales of radio sets by the radio industry as a whole during the year showed a serious decline and their own sales followed the

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STOCKS AND SHARES

TUESDAY EVENING.

IT is not surprising to find that Stock Exchange markets in this present week are quiet to the verge of being uninteresting. Public money is coming in freely to the Defence Bonds and the National Savings Certificates. Probably the inflow of capital to these issues has some influence upon the investment business in the Stock Exchange, though when shares are offered at what the purchasers consider attractive prices, those shares do not remain available for any length of time.

Prices generally speaking are steady, amongst the outstanding features being the strength of home railway, cable and wireless stocks.

London Transport "C" Stock

The London Transport Board was taken over by the Government at the outbreak of war. A minimum price of 65 for the "C" stock was fixed by the Treasury. A note issued by a firm of dealers in the home railway market suggests that the basis of Government compensation should bear some relation to the terms of the Act which controls both the charges and the dividend on the "C" stock. A section of the Act is quoted as follows:—

"It shall be the duty of the Board to conduct their undertaking in such a manner and to fix such fares and charges in accordance with the provisions of this Act as to secure that their revenue shall be sufficient to defray all charges which are by this Act required to be defrayed out of the revenue of the Board."

In failing to provide for payment of the "standard" 5½ per cent. dividend on the "C" stock, the Board neglected, it is claimed, this instruction in the Act, for it was not until January of this year that application was made for an upward revision of fares.

Home Rails

If the special circumstances of London Transport "C" stock are taken into account, the basis of the Government compensation terms will presumably differ from those applied to the main line railway issues. Speculation as to the latter terms, which are still unknown, has been increasingly optimistic in recent weeks. While the Transport "C" stock has remained friendless at the official minimum price, the main line companies' stocks have left the unofficial minima so far behind as to cause their abolition. The upward movement got into its stride again this week, with rises of 2 points in Southern preferred to 65, and of 1 point in the 5 per cent. preference to 89.

Equipment and Manufacturing

Industrial markets are without decided direction for the time being; but, given some practical reason for doing so, interest is ready enough to show itself in individual shares. This, presumably, is what is meant by the oft-used term "selective demand." One or two electrical equipment and manufacturing shares are being singled out in this way. Reference has been made to the jump in the price of Tube Investments after the annual meeting. Demand has persisted for J. Lucas shares, which are now quoted at 55s., against 45s. at one time within the last two months. The yield is down to 5½ per cent. The return of well over 7 per cent. on Enfield Cables has attracted buyers; the price is 1/6 higher at 46s. 3d.

Price Movements

Reyrolles, at 57s. 6d. have risen half-a-crown in a fortnight. Lancashire Dynamos have jumped from 50s. to 55s.; this Company paid 25 per cent. for last year, but the October interim payment was lowered from 7½ to 5 per cent. The shares of Hopkinsons, the company which supplies boiler valves and mountings to many of the big power stations, are a strong market at 41s. 3d., being 3s. 9d. up on the week. London Electric Wires are a dull exception at 26s. 3d. The S. Smith & Sons report made a good impression, but caused no change in the price of the 1s. deferred shares, which receive a 50 per cent. dividend and stand at 7s. 6d. Dictograph Telephone 2s. shares, at 1s. 9d. x.d., return 8 per cent. on the dividend which has been reduced from 10 per cent. to 7 per cent., although earnings were fairly well maintained. Murex have taken a turn for the better at 75s. Perak Hydro-Electrics are 6d. better at 18s. 9d. The price of tin, released from control, has risen £42 per ton this week, and this is taken to presage prosperity for any company associated with the tin industry.

Preference Stock on Offer

A few hundred 6 per cent. 10s. preference shares of General Cable Manufacturing are on offer at 9s. 3d., to yield nearly 6½ per cent. Payment of the dividend takes £4,500 annually, and is covered four times by the profits, after tax, shown in the lately issued accounts for the year ended in September. Earnings were slightly above those for 1938, and a 12 per cent. dividend is declared on the ordinary capital. Investors with a predilection for preference shares quoted near the par value should note that London Associated Electricity 4½ per cent. preference shares are on offer at 20s. 3d. to yield £4 8s. 9d. per cent; Mid-Cheshire Electric 4 per cent. Preference at 19s., to yield £4 4s. 3d. per cent.; and South Metropolitan 4 per cent. third preference at 18s. 3d., paying £4 7s. 6d. per cent. on the money. The security is, needless to say, of a high order in every case. British Thomson-Houston 7 per cent. preference shares are in the market at 30s.; the return works out at £4 13s. 3d.

Tube Investments

Mr. Arthur Chamberlain generally gives his shareholders original food for thought at the Tube Investments annual meetings. His review of wartime conditions and policy at last week's meeting stimulated a fresh demand for the shares, which put on half-a-crown to 87s. 6d. On the 23¾ per cent. dividend, the yield works out at barely 5½ per cent., which, in comparison with the run of yields on industrial shares, signifies an investment rating near the top class—the more so because of the chairman's assurance that any increase in the dividend is out of the question during wartime. On the other hand, there is said to be scarcely any chance of a reduction. This possibility is to be guarded against by the usual conservative use of the profits. Some day, said the chairman, there might be a plum for the shareholders to pick: the world's power of recovery at the end of the war will decide.

Electrical Musical Industries 10s. shares have been changing hands at a few pence above the official list quotation of 7s. since last week's annual meeting. At that meeting, Mr. Alfred Clark weighed up the debits and credits of wartime conditions. So far as the ordinary business is concerned, the greater need for home entertainment should help to offset the inevitable difficulties. In any case, the factories are going to be fully employed.

Miscellaneous Matters

The continued stability of prices in the market for electricity supply shares confirms the impression that the adjustment of yields to the new situation has been completed. Persistent buying of Cable and Wireless stocks has raised both the ordinary by 4 points to 57½ and the preference by 1 to 93½. The ordinary now stands at the best price of the year, and the preference is within a couple of points of that mark. Great Northern Telegraphs are flat, at 20½, on the Scandinavian position. Brazilian Tractions have gained ½ further, to 10⅜, on the still unconfirmed hopes of British Government purchases in Brazil and a consequent easing of the exchange difficulty. Anglo-Argentine Trams income stock has relapsed to 10 after the recent activity up to 13. Nigerian Electricity shares are on offer at 13s. 9d. For the year to February, 1939 the dividend was only 3¾ per cent., reflecting the much reduced activity in the local tin mines. In better circumstances, such as those in prospect, the dividend has been up to 7½ per cent. In the gilt-edged market, the disposition seems to be to mark time in advance of the appearance of the first market defence loans. The market in rubber shares remains apathetic. Investment declines to show any interest in spite of the good profits that producing companies make with rubber at nearly 1s. per lb.

Dollar Stocks

One reason for Wall Street's persistent dullness, in the face of circumstances which ought, it would seem, to make for cheerfulness, is the existence of the large British and other European holdings of dollar securities. In all probability, the time will come for our Government to take over these holdings, which could be sold, or otherwise dealt with in America, with the object of providing dollars for the purchase of American goods. The same was done in the last war. On the present occasion, the Treasury has already taken the first step in ordering the registration of foreign investments. An idea of the amount involved is given by American estimates published last week, showing that British investors hold marketable American securities to the value of over £183 millions. Adding French marketable investments, together with all dollar balances and other investments, the grand total of £700 millions is reached. If the time came for mobilisation of these assets, any selling would, it goes without saying, be carried out in such manner as to cause the least disturbance to the market. Its prospect is considered, nevertheless, to be almost as much of a restraining influence as is the ban on the purchase of dollar stocks by residents in this country.

Supply Associations Committee

A WAR Emergency Committee has been set up under the title of the Joint Committee of Electricity Supply Associations. The members are as follows:—Mr. J. Mould, Mr. B. Handley and Mr. H. C. Lamb, representing the I.M.E.A.; Mr. W. McGill (I.A.E.P.C.) (substitute: Col. S. E. Monkhouse), Mr. J. C. Dalton (L.E.S.A.) and Mr. S. S. Grant (P.E.S.A.), representing the Joint Committee of Company Associations; Mr. L. Gordon (London J.E.A.), hon. sec. Conference of Joint Electricity Authorities, etc. Mr. J. W. Simpson (I.M.E.A.) and Mr. A. Home-Morton (I.A.E.P.C.) are the joint secretaries. Mr. J. Mould is chairman and Mr. J. C. Dalton, deputy-chairman.

All matters of importance and of common interest to the electricity supply industry, arising during the period of the war will receive consideration, and immediate action will be taken where necessary. The Committee has offered its services to the Minister of Transport, with a view to advising him on the many matters arising during the war, which will come before him.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 High-est	1939 Low-est	Dividend Pre-vious	Dividend Last	Price Dec. 12	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies							
Bournemouth and Poole	68/3	57/–	15	15	58/9	—	5 2 0
British Power and Light	30/9	21/–	7	7	26/–	—	5 7 8
City of London	33/9	23/6	7½	7½	25/6	+6d.	6 0 0
Clyde Valley	37/9	27/6	8	8	33/3	—	4 16 3
County of London	46/9	28/–	10½	10½	36/3	—	5 16 0
Edmundson's :							
7% Pref.	31/6	27/6	7	7	28/–	—	5 0 0
Ord.	27/9	18/6	9	6	23/6	—	5 2 2
Elec. Dis. Yorkshire	41/6	32/6	9	9	35/9	—	5 0 5
Elec. Fin. and Securities	47/9	40/–	12½	12½	40/–	—	6 5 0
Elec. Supply Corporation	51/9	41/–	12	12	41/3	—	5 16 0
Isle of Thanet	20/–	15/–	4	4	15/–	—	5 6 8
Lancs Light and Power	34/6	25/–	7½	7½	28/9	—	5 4 4
Llanelly Elec.	22/6	17/6	5½	5½	18/–	—	6 2 3
Lond. Assoc. Electric	30/–	18/3	7	7	18/9	+6d.	7 9 4
London Electric	34/3	22/6	7	7	25/–	—⅛	5 12 0
London Power Deb. Red.	106½	98	5	5	103½	—	4 16 6
Metropolitan	51/–	35/–	12	12	37/–	—	6 9 9
Midland Counties	38/9	30/–	8	8	35/–	—	4 11 5
Mid. Elec. Power	41/9	35/–	8	9	36/3	—	4 19 4
Newcastle Elec.	28/9	26/–	7	7	26/3	—	5 6 8
North Eastern Electric :							
Ordinary	32/3	23/6	7	7	27/6	—	5 1 10
7% Pref.	32/6	27/6	7	7	30/–	—	4 13 4
Northampton	48/–	41/–	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	12½	11½	6	6	11½	—	5 4 4
Northmet Power :							
Ordinary	46/6	30/6	10	10	37/6	—	5 6 8
6% Pref.	29/–	23/6	6	6	27/–	—	4 9 0
Richmond Elec.	29/–	21/6	7	7	23/9	—	5 18 0
Scottish Power	38/9	28/6	8	8	32/6	—	4 18 6
Southern Areas	22/9	17/–	5	5	18/–	—	5 11 1
South London	30/9	23/9	7	7	22/–	—	6 7 3
West Devon	23/3	18/9	5	5	18/9	—	5 6 8
West Glos	21/3	16/3	2	2½	16/3	—	3 1 6
Yorkshire Elec.	38/6	28/9	8	8	33/9	—	4 14 10
Overseas Electricity Companies							
Atlas Elec.	4/3	1/6	Nil	Nil	3/–	—	—
Calcutta Elec.	39/–	25/–	10*	10*	30/6	—	—
Cawnpore Elec.	34/6	28/3	10	10	27/6	—	—
East African Power	26/3	20/–	7	7	23/6	—	5 19 2
Jerusalem Elec.	24/6	21/–	7	7	21/–	—	6 13 4
Kalgoorlie (10/–)	10/6	9/–	7½	7	10/–	—	7 0 0
Madras	31/–	21/3	8*	8*	21/3	—	—
Montreal Power	35½	30	1½	1½	33½	—	—
Palestine Elec. "A"	29/6	20/–	7½*	5*	25/–	—	4 0 0
Perak Hydro-electric	18/9	13/6	6	2½	18/9	+6d.	2 13 4
Shawinigan Power	25	20	85cts.	83cts.	25	—	—
Tokyo Elec. 6%	63	37	6	6	60½	−2	9 18 4
Victoria Falls Power	73/9	60/–	12½	15	68/9	−⅛	4 7 3
Whitehall Investments Pref.	19/6	12/6	7½	7½	14/–	—	10 14 2
Public Boards							
Central Electricity :							
1950–70	112	103	5	5	106½	—	4 14 0
1955–75	115½	104½	5	5	108	—	4 12 6
1951–73	106½	101	4	4½	103	—	4 7 3
1963–93	95½	84	3½	3½	89	+1	3 18 7
London Elec. Trans. Gtd.	88½	83	2½	2½	87	—	2 17 6
London & Home Counties							
1955–75	107½	105	4½	4½	107	—	4 4 1
Lond. Passenger Transport :							
A	114½	103	4½	4½	107½	—	4 4 6
B	117½	102	5	5	105½	—	4 14 9
C	83½	64½	4	1½	65	—	2 6 2
West Midland Joint Elec.,							
1948–68	112½	104½	5	5	106	—	4 14 4
Telegraph and Telephone							
American Tel. & Tel.	210	159	9	9	210	—	4 5 8
Anglo-Am. Tel. :							
Pref.	101½	82	6	6	92½	—	6 9 9
Def.	23⅝	18½	1½	1½	21½	—	6 19 6
Anglo-Portuguese	24/–	17/6	8	8	20/–	—	8 0 0
Cable & Wireless :							
5½% Pref.	95½	75	4½	5½	93½	+1	5 17 8
Ord.	57½	34	4	4	57½	+4	6 19 2
Income	100	87½	—	—	92½	+1	4 6 5
Canadian Marconi $1	6/–	3/9	—	Nil	5/–	—	—
Globe Tel. & Tel. :							
Ord.	31/3	23/6	7½*	7½*	27/6	—	5 9 1
Pref.	26/9	22/6	6	6	25/–	—	4 16 0
Great Northern Tel. (£10)	38	20	20	20	20½	−4	9 15 2
Inter. Tel. & Tel.	10½	5½	Nil	Nil	5½	−1	—
Marconi-Marine	30/–	23/–	7½	10	26/3	—	7 12 4
Oriental Telephone Ord.	2½	46/3	12*	12*	2 5/16	—	5 4 0
Radio Corpn.	8⅞	5⅜	8	6	7½	—	—
Telephone Props.	14/–	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/–)	10/–	7/–	10	10	8/–	+3d.	6 5 0
Western Union	40½	19½	2⅜	—	35½	—	—
Traction and Transport							
Anglo-Arg. Trams :							
First Pref. (£5)	7/6	3/6	Nil	Nil	5/–	—	—
4% Inc.	16	5	Nil	Nil	10	−3	—
British Electric Traction :							
Def. Ord.	1025	515	5	5	700	—	—
Pref. Ord.	164	130	8	8	142	—	5 12 8
Bristol Trams	52/6	36/3	8	10	42/–	—	4 15 5
Brazil Traction	13	7⅛	$1	50c.	10⅜	+⅛	—
Calcutta Trams	25/6	20/9	8	8	21/3	—	7 10 6
Cape Elec. Trams	18/–	16/9	5	5	17/6	—	5 14 4
Lancs Transport	37/9	27/6	10	10	30/–	—	6 13 4
Mexican Light :							
1st Bonds	28	20	5	5	27½	—	—
Rio 5% Bonds	81	47	5	5	75	—	6 13 4
Southern Rly. :							
5% Prefd.	75½	48	5	5	65	+2	7 13 9
5% Pref.	99½	79	5	5	89	+1	5 12 4
T. Tilling	2½	32/6	10	10	38/9	—	5 3 3
Tilling & B.A.	54/6	43/9	10	9*	45/–	—	4 2 3
West Riding	37/9	30/–	10	10	30/–	—	—
Equipment and Manufacturing							
Aron Electricity Ord.	32/3	22/6	15	15	22/6	—	—
Assoc. Elec. :							
Ord.	45/3	31/3	10	10	40/–	—	5 0 0
Pref.	36/6	31/3	8	8	32/6	—	4 18 6
Automatic Telephone & El.	47/6	39/3	10	12½	42/6	—	5 17 8
Babcock & Wilcox	48/–	37/–	10	12½	40/9	—	6 2 7
British Aluminium Ord.	58/9	48/9	12½	12½	50/9	−6d.	4 18 5
British Insulated Ord.	88/–	72/6	20	20	80/–	—	5 0 0
British Thermostat (5/–)	16/–	12/–	18½	18½	12/6	—	7 8 0
British Vacuum Cleaner (5/–)	22/6	12/6	40	40	12/6	—	—
Brush Ord.	5/9	3/9	Nil	Nil	3/9	—	—
Callender's	92/–	52/6	20	15	60/–	—	5 0 0
Chloride Elec. Storage	82/3	62/6	20	15	3½	—	4 5 9
Consolidated Signal	96/–	62/6	36½	36½	65/–	—	9 14 8
Crabtree (10/–)	25/6	17/6	17½	17½	21/3	—	8 4 9
Crompton Parkinson :							
Ord. (5/–)	21/–	12/6	15	20	17/6xd.	+6d.	5 14 3
E. K. Cole (5/–)	9/–	3/–	10	Nil	4/–	—	—
Elec. & Musical Industries (10/–)	14/9	7/–	5	Nil	7/–	—	8 0 0
Electric Construction	38/6	31/–	12½	13½	33/9	—	7 4 5
Enfield Cable Ord.	58/6	42/6	25	16½	46/3	+1/16	7 0 5
Electrical Switchgear (10/–)	27/–	21/–	16	10	21/3	—	4 14 3
English Electric	36/6	25/–	10	10	32/6	—	6 3 1
Ensign Lamps (5/–)	16/9	13/9	25	25	15/–	—	8 6 8
Ericsson Tel. (5/–)	43/–	35/–	25*	25*	37/6	—	3 6 8
Ever Ready (5/–)	25/–	18/–	35	30	25/–	—	6 0 0
Falk Stadelmann	27/–	17/6	10	6	18/9	—	6 13 4
Ferranti Pref.	25/6	22/–	7	7	22/–	—	6 7 3
G.E.C. :							
Pref.	31/9	26/3	6½	6½	27/6	—	4 14 6
Ord.	82/–	61/3	17½	20	75/–	—	5 4 4
Greenwood & Batley	27/6	22/6	7	15	22/6	—	13 6 8
Hall Telephone (10/–)	22/3	18/6	15	15	18/9	—	8 0 0
Henley's (5/–)	21/–	15/–	20	20	17/6	—	5 14 3
4½% Pref.	23/–	18/9	4½	4½	18/9	—	4 16 0
Hopkinsons	46/3	37/3	12½	15	41/3	+3/16	7 5 0
India-Rubber Pref.	21/3	18/9	5½	5½	20/–	—	5 10 0
Intl. Combustion	120/–	97/–	32½	32½	5½	—	6 3 10
J. Lucas	60/–	45/–	15	15	55/–	+1/16	5 9 1
Johnson & Phillips	41/3	32/–	12½	12½	41/3	+1/16	6 1 4
Lancashire Dynamo	72/–	50/–	25	25	55/–	+¼	9 2 0
Laurence Scott (5/–)	12/–	9/6	15	15	9/6	—	7 18 4
London Elec. Wire	31/6	26/–	12	7½	26/3	−⅛	5 14 4
Mather & Platt	50/–	39/–	13½	13½	45/–	—	6 0 0
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 0
Murex	85/9	63/9	20	20	75/–	+⅛	5 6 8
Pye Deferred (5/–)	13/9	7/6	25	25	7/6	—	16 13 4
Revo (10/–)	35/6	25/–	17½	17½	25/–	—	7 0 0
Reyrolle	61/–	52/6	12½	12½	57/6	+1/16	4 7 0
Siemens Ord.	26/9	18/9	7½	7½	20/–	—	7 10 0
Strand Elec. (5/–)	5/6	2/–	10	4	2/–	—	8 0 0
S. Smith (1/–)	9/–	6/–	37½	50	7/6	—	6 13 4
Switchgear & Cowans (5/–)	15/–	10/–	20	20	11/3	—	8 18 0
Telegraph Condenser (10/–)	7/6	5/–	5	—	7/6	—	—
Telegraph Construction	2⅛	32/6	10	10	32/6	—	6 3 1
Telephone Mfg. (5/–)	10/–	7/–	9	9	8/–	—	5 12 6
Tube Investments	91/–	72/6	23¾	23¾	87/6	+½	5 9 6
Vactric (5/–)	4/3	2/3	10	4	2/3	−3d.	—
Vickers (10/–)	24/6	14/6	10	10	16/6	—	6 1 3
Ward & Goldstone (5/–)	22/6	19/6	20	20	19/9	—	5 1 3
Westinghouse Brake	54/9	36/–	17½	17½	2¼	—	7 15 6
Walsall Conduits (4/–)	31/9	21/3	55	55	25/–	—	8 16 0
West, Allen (5/–)	7/6	5/9	7½	10	5/9	—	8 14 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia.—SYDNEY.—January 4th. Sydney County Council. Electricity Undertaking. Insulating-oil treatment equipment. General manager.

BRISBANE.—January 15th. City Electric Light Co., Ltd. Two steam boilers and accessories. H. Baskerville, secretary, Boundary Street, Brisbane, Queensland.

February 14th. Nine automatic voltage regulators. (T. 29608/39.)*

Edinburgh.—December 18th. Electricity Committee. High-voltage switchgear to Spec. No. 178. Forms, &c., from Mr. E. Seddon, engineer and manager, Electricity Department, Dewar Place; tenders to town clerk.

Erith.—January 1st. Electricity Department. Wiring of lighting and water heating points, and extension to fire alarm system at Bedonwell Hill School extension, Belvedere. (See this issue.)

Hucknall.—January 8th. U.D.C. Electrically driven pumping set at Salterford pumping station. Specifications from Rofe & Raffety, 42, Salisbury Avenue, Cheam (deposit £2 2s.).

Iran.—TEHRAN.—Janauary 6th. Centrale Electrique de Tehran. Electrical plant, including turbo-alternators, high-voltage cable, transformers, &c. (T. 29037/39.)

Manchester.—December 21st. Electricity Committee. One 200-kW and one 40-kW rectifiers. (December 8th.)

Morecambe and Heysham.—January 5th. Electricity Department. Supply, jointing and pressure testing of e.h.v. cables. Excavating, laying and permanent reinstatement. (See this issue.)

New Zealand.—WELLINGTON.—Public Works Department. January 9th (Extended date). 50-kV outdoor switchgear for Hangatiki sub-station and 110 kV outdoor switchgear and steelwork for Ongarue sub-station. (T. 27495/39.)* Four 10,000-kVA transformer units. (T. 27496/39.)*

January 2nd. Fifty 5-kV transformers. (T. 27809/39.)*

January 16th. Two sets of 11,000-V metal-clad switchgear. (T. 28857/39.)*

January 23rd. Four 110 kV three-phase outdoor isolating switches. (T. 29122/39.)*

February 6th. Two motor driven centrifugal pumps. (T. 29120/39.)*

February 13th. Three single-phase transformer units. (T. 28146/30.)* Two 2,250-kVA three-phase boosting transformers. (T. 28144/39.)* Remote control equipment. (T. 28791/39.)*

February 20th. Seven single-phase transformer units. (T. 28148/39.)* Four single-phase transformer units. (T. 28147/39.)*

February 27th. 22,000-V switchgear. (T. 28858/39.)* 11,000-V switchgear. (T. 28789/39.)*

March 26th. Four single-phase transformer units. (T. 28143/39.)*

March 12th. 110-kV outdoor switchgear and steelwork. (T. 28145/39.)*

South Africa.—CAPE TOWN.—January 15th. Electricity Department. Booster pumps, complete with driving motors, &c., and piping, two sets of motor starting and control gear, two 3,300-V iron-clad switchboards, two 380/220-V iron-clad distribution boards and one overhead travelling crane. (T. 27966/39.)*

JOHANNESBURG.—January 6th. City Council. Two 750-kW rotary convertors. (T. 29349/39.)

January 17th. Automatic fire protection equipment. (T. 29487/39.)

Sunderland.—Alterations and additions to electrical installation at Municipal Hospital (£2,739); J. E. Lewis, borough engineer, Town Hall, Sunderland.

Taunton.—December 22nd. Equipping small dwellings with electric lighting installations, for Electricity Department; L. V. Turner, borough electrical engineer.

Wolverhampton.—December 18th. West Midlands Joint Electricity Authority. Coal storage plant for Ironbridge power station. (November 24th.)

January 15th. Electrical Engineer's Department. E.h.v. switchgear. (See this issue.)

Orders Placed

Barrow-in-Furness.—Electricity Committee. Accepted. Kiosk (£372).—Metropolitan-Vickers Electrical Co.

Brighton. — Corporation. Accepted. Screens for circulating water system, Southwick power station.—F. W. Brackett & Co. Sluice valves, circulating-water system.—J. Blakeborough & Sons.

Electricity Committee. Accepted. Ventilation improvements at power station (£1,480).—Sturtevant Engineering Co. 50,000-kW turbo-generator with ancillary apparatus (£185,000).—Brush Electrical Engineering Co.

Cardiff.—Electricity Committee. Accepted. 80-ton electric travelling crane for Roath power station (£5,420).—Babcock & Wilcox. Switchgear (£383).—Whitehead (Switchgear Inventions), Ltd. Electric vehicle battery (£83).—W. Lewis & Sons.

Carlisle. — Electricity Committee. Accepted. Transformers. — Yorkshire Electric Transformer Co. (on basis of expiring contract).

Health Committee. Accepted. Radio equipment for City Hospital (£88).—L. R. Booth & Co.

Chesterfield. — Electricity Committee. Accepted. Switch unit (£116).—Switchgear & Cowans.

Hampton.—Metropolitan Water Board. Accepted. Cable for pumping station (£404).—Aberdare Cables.

Leeds. — Housing Committee. Accepted. Electrical work at 40 houses on the Potternewton estate.—Ward & Co. (Dewsbury).

Health Committee. Accepted. Installation of lift at Killingbeck Hospital (£1,027).—Waygood Otis.

Electricity Committee. Accepted. E.h.v. switchgear (£1,358).—English Electric Co. L.v. switchgear (£564).—G.E.C. Water screens (£2,062).—F. W. Brackett & Co.

Wallasey.—Gas Committee. Accepted. Power plant for gas works (£1,793).—G.E.C.

Worthing.—Sewage Committee. Accepted. Electric pump (£111).—Lee, Howl & Co.

Financial Section (*concluded from page 774*)

Reports and Dividends—contd.

trend of the market. Their companies were not making receiving sets in the very lowest price categories, while in the highest price models buying was curtailed for obvious reasons of economy. On the other hand, their medium price models had more than held their own in competition.

With regard to television, the principal achievements during the year under review were definite advances in the quality of receiving sets, an important reduction in the retail prices, a more stabilised production in the factories due to manufacture in larger quantities, and an increase in expenditure by the B.B.C., which enabled the staff at the studios to improve their technique. A further development in research was the completion of the apparatus for projection of television images on large screens suitable for public exhibition in cinemas. It was unfortunate that the television service had had to be closed down.

With regard to the future, the manufacture of all luxury goods would probably be hampered by interrupted or restricted supplies of raw materials as well as by shortage of labour required for work of national importance. Manufacturing costs were thus likely to rise, but as against these drawbacks, with abundant employment throughout the country there would be more money spent, and the desire of home entertainment was likely to increase. There should be an increasing demand for gramophone records, but the sale of radio receiving sets would probably be smaller than last year, showing a tendency towards an increase in the proportion of lower price sets.

The India Rubber, Gutta Percha and Telegraph Works Co., Ltd.—In the course of his speech at the annual meeting held on December 13th Sir Walrond Sinclair (chairman) said that it was now over six years since the company first became associated with the British Tyre & Rubber Co., Ltd., and a little over four years since the rebuilding and modernisation of the works was commenced. As a result, they could justifiably claim that the concern had been given new life and brought up to date in every respect. The co-ordination of activities between the company and the other members of the group was continually being strengthened and it was already clear that this co-operation would be increasingly valuable under war conditions.

Ensign Lamps, Ltd.—Presiding at the annual meeting held on December 7th Mr. G. W. Fletcher (chairman) said that notwithstanding a year of many difficulties, owing to the uncertainty caused by the European situation, the expected increase of profits arising from the completion of the new works had been fulfilled. When war had actually been declared the question that had exercised their minds was what was going to be the effect on the lamp industry, and especially what the effect would be of A.R.P. lighting restrictions, &c. Since they had now had five months of trading in their new financial year, and three months under war conditions, he was happy to tell the shareholders that as yet they had not suffered, but were maintaining their normal progress, and the demand for Ensign lamps had steadily increased. Granted a continuance of trading such as experienced thus far, they anticipated having another successful year.

The General Cable Manufacturing Co., Ltd., reports a net profit for the year to September 30th of £22,585, as compared with £19,878 in the preceding year. As already announced, the final ordinary dividend is 6 per cent., making 12 per cent for the year (same), tax requires £4,000, and £5,000 is placed to reserve. The balance carried forward is £1,862 (as compared with £1,777 brought in).

The Amazon Telegraph Co., Ltd., reports a gross revenue of £26,556 for the year to June 30th, as compared with £26,357 in the previous year, and after deducting expenses a profit of £550 (against a loss of £3,156). The balance carried forward is £4,529 (against £3,979 brought in).

The United Electric Tramways of Caracas reports a loss to June 30th, after meeting interest on first and second debentures, of £11,231 (against £11,323), increasing the debit carried forward to £11,827. Interest on mortgage and loans chargeable to local tramway company for the year is £15,450, but that company remitted only £450. This sum only is credited to profit and loss account and the balance (£15,000) is placed to credit of reserve against that company's indebtedness.

The Electric Furnace Co., Ltd., has declared an interim dividend of 3½ per cent. (against 2½ per cent.).

The Lisbon Electric Tramways, Ltd., is paying an interim dividend of 2½ per cent., tax free (against 3 per cent.).

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashford (KENT).—Two shelters, for U.D.C.; surveyor, 5, North Street.

Ayr.—Boiler house, &c., for Scottish Stamping and Engineering Co., Neptune Works, to cost £3,000; manager.

Bilston.—Extensions to factory, Bradley & Co., Albion Works; A. E. Baxter, architect, Walsall Street, Willenhall.

Blackpool.—Land development, St. Annes Road; Beardshaw & Co.

Bolton.—Extensions to works, St. Paul's Worsted Mills, Ltd., Caroline Street; Bradshaw, Gass & Hope, architects, 19, Silverwell Street.

Brighouse.—Extensions to Woodhouse Works of J. Blakeborough & Sons; A. Turner & Son, architects, 11, Clegg Street, Oldham.

Extensions to Clifton Bridge Mills, for Woodhouse & Mitchell, Ltd., Wakefield Road; Lister Brook & Co., Ltd., contractors, Owler Ings Road, Brighouse.

Bromsgrove.—Additions to "Royal Oak," Wildmoor; F. Smith, Ltd.

Caernarvonshire. — Joint gymnasium for Portmadoc Council School and the Central School, for the E.C.; W. Lloyd Jones, county architect, County Offices, Shirehall Street, Caernarvon.

Alterations and additions, Bryn-yr-Efail, for the E.C.; G. & J. P. Gregory, contractors, 24, High Street, Caernarvon. Cost £12,873.

Carlisle.—Alterations to shop premises for Jacksons, Ltd., tailors; T. Irwin and Son, builders, Strawberry Lane, Newcastle-on-Tyne.

Chesterfield. — Factory, Lordsmill Street; British Electrical Repairs, Ltd.

Additions, Sheepbridge Works; Stokes Castings Co., Ltd.

Alterations and additions, Royal Oak Inn, Chester Street; Brampton Brewery Co., Ltd.

Additions, police buildings (£6,000); Holmes, Son & Archer.

Chorley.—Houses and garages, Blackburn Road; J. W. Lee, Ltd. Factory, Hornby Road, Lancashire Concrete Products, Ltd.

Cramlington (NORTHUMBERLAND).—Rebuilding the Railway Tavern; J. & W. Lowry, contractors, Corporation Street, Newcastle.

Darlington.—School air raid shelters for the E.C. Contractors: W. S. Hutton, Ltd., H. W. Andrew, Parvin and Son, Blackett and Son, Mackenzie Brothers, Dougill and Son, Bussey and Armstrong, Dickinson and Son, Lawson and Boddy and W. H. Bean, all of Darlington.

Darwen.—Works at Whitehall Mill; Lancashire Thread Co., Ltd., Victoria Mill, Turton.

Derby.—Churches and mission rooms (£70,000), new housing estates, for C.E. Diocesan Board.

Dumfries.—Operating theatre (sterilising room) at Charnwood Maternity Hospital, for Town Council, to cost £1,120; R. S. Osborne, master of works.

Durham. — Houses; R.D.C. housing architect, Sadler Street, Durham.

Edinburgh.—Store and office, Pipe Street, Portobello; A. Strang (Tractors), Ltd., Duddington Gardens South. Workroom and shelters, for Victoria Rubber Mills, 236, Leith Walk, Leith.

Enfield.—Factory and offices, Stockingswater Lane; Moneys Patents, Ltd., 111, Dalston Lane, E.8.

Glasgow.—Alterations to St. Rollox Refuse Disposal Works, for Corporation Cleansing Department; Leitch & Sharpe, architects, 65, Bath Street.

A.R.P. shelters and stores, for James Craig (Glasgow), Ltd., 10, Woodlands Road; Clarke Bell and J. H. Craigie, architects, 227, Bath Street.

Gloucestershire.—Block at North Gloucestershire Technical College, Cheltenham (£15,000), for E.C.; director of education, Gloucester.

Hale.—Junior and infants school, Timperley, for R.C. Authorities; H. Greenhalgh, architect, 15, Mawdsley Street, Bolton.

Harrogate. — Reconstruction, Market Hall, Market Place, borough surveyor.

Hanley.—Works extensions, Weaver Street; R. H. Bell, Ltd.

Warehouse extensions, Swan Street; J. Titley & Sons, Ltd.

Haverfordwest. — Factory, Merlins Bridge, for Cow and Gate, Ltd.; Guildford.

Hebburn-on-Tyne. — Nineteen public shelters, for the U.D.C.; Tarslag, Ltd., builders, Stockton-on-Tees. Report and control centre; U.D.C. surveyor.

Hendon.—Extensions to works, Tilley Lamp Co., Brent Works, Brent Street.

Additions to the Surrey Arms, Edgware Road, for Truman, Hanbury, Buxton & Co., Ltd.

Hereford.—Pectin factory, Moorfields; H. P. Bulmer & Co., Ltd.

Hinckley.—Extensions to factory, for Huckerby & Growdridge, New Road.

Hoylake.—Licensed premises, site adjoining Arrowe Brook, at Greasby Road; W. M. and M. W. Shennan.

Keighley.—Bungalows (22); borough surveyor.

New warehouse, for John P. Heaton & Co., Low Mill Lane.

Kettering.—Housing schemes (£66,498); borough surveyor.

Lanchester (CO. DURHAM).—Modified scheme for new hospital (partly constructed), to cost £23,000; George Gradon & Sons, contractors, North Road, Durham City.

Leeds.—Ambulance station; Gribbon & Foggitt, architects.

Boiler house, St. James Hospital; city engineer.

Leek.—Factory, Nelson Street, for Co-operative Wholesale Society, Ltd.

London.—(BERMONDSEY).—Modernising St. Olave's Institute as community centre, and extensions, Redruff Community Centre; borough surveyor.

Church and hall, Rotherhithe Street; Arnold Fooks Chadwick & Co., 15, Bolton Street, W.1.

(CAMBERWELL).—Cleansing station at Council's depôt, 52, Camberwell Green; William Bell, borough surveyor, Town Hall, Peckham Road, S.E.5.

(FULHAM).—Flats, Carnwath Road (£9,758), and North End Road (£57,259); borough surveyor.

(S.E.).—Factory and shelter, 120, Tower Bridge Road and 78-91, Grange Walk; L. Kennard, Arch Railway Approach, S.E.1.

(WESTMINSTER). — Premises, Davies Street, Gilbert Street and Weighhouse Street; Howard & Souster, architects, 81, Piccadilly, W.1.

Manchester.—Extension to printing works, for the Co-operative Wholesale Society, Ltd., Balloon Street, Manchester.

Additions to works, Newton Avenue and Vernon Street, Longsight, for Parmiter, Hope & Sugden, Ltd., Newton Avenue; Mason & Co. (Builders), Ltd., contractors, Taylor Lane Saw Mills, Denton, Manchester.

Mansfield.—Infectious Diseases Hospital in Southwell Road, for South Notts Joint Hospital Board.

Mere.—Fire station, Tisbury, and adaptation of fire station at Mere, for R.D.C.; H. Hiscott, clerk, Mere.

Middlesbrough.—Extensions to premises for Watson & Coates, Ltd., Grange Road; Kitching & Co., architects, 21, Albert Road.

Midhurst.—Houses for agricultural workers; R.D.C. surveyor.

Monmouthshire.—Junior and infants' school, Blaina (£24,640), for E.C.; county architect, County Hall, Newport.

Netherton (DUDLEY).—Works extensions, for Walker Bros., Ltd.

Northallerton.—Extensions to the Isolation Hospital; U.D.C. surveyor.

Northern Ireland.—(BELFAST). — New factory for Orlo Leather Boards, Ltd., Joy Street.

Northumberland. — Additional air-raid shelters at the Bedlington, Seaton Valley-Backworth and Earsdon Schools, for the C.C.; county architect, County Offices, Morpeth.

Schools at Humshaugh, St. Anthony's, and parsonage at St. Peter's, Balkwell, North Shields, for the Newcastle Diocesan Conference; A. D. Minton Stenhouse, secretary, 81, Kenton Road, Gosforth, Northumberland.

North Shields.—Hotel, Chirton, for J. Rowell & Son; J. Oswald & Son, architects, Northumberland Street, Newcastle-on-Tyne.

Nottingham.—Nurses' home, Hucknall Road, for the governors of Nottingham General Hospital; William Woodsend, Ltd., contractors, Wharf Road, Castle Boulevard, Nottingham.

Peterborough.—Additions to factory, Walton; Peter Brotherhood, Ltd., engineers. Additions to offices, Walpole Street; L. & N.E. Railway Co.

Prinknash (GLOUCESTERSHIRE).—Convalescent home (£100,000), the Abbey; H. S. Goodhart Rendell, architect, 13, Crawford Street, London, W.1.

Reading.—First aid post and clinic, grounds of Grovelands Council School, for T.C.; borough surveyor.

Rochdale.—Lily Hill Dyeing Co., Ltd., Whitefield, has acquired Simpson's Clough Works, Rochdale, as extensions to the dyeing works. Electrical work.

Extensions, Birch Hill Laundry, for P.A.C.

Rocester (STAFFS). — Extensions to Abbotsholme School; Oakley & Sandville, architects, 60, King Street, Manchester.

Rotherham.—Development at Hill Top Lane; A. Watson, builder, Grange Farm.

Scunthorpe.—Dairy for Co-operative Society, Ltd., High Street; Betts and Newbert, contractors, 165, Frodingham Road, Scunthorpe.

Sedgefield.—Twenty-nine public shelters; R.D.C. surveyor.

Sheffield.—Shops, houses and garages, Carterknowle Road and Springfield Avenue, for G. Handley, Carterknowle Road.

Houses, Highcliffe Drive, for Ackroyd and Abbott, 61, Studley Road, Attercliffe, Sheffield, 9.

South Shields.—Public hall at Hardings Hill; Black's Regal Theatres, Ltd.

Air-raid shelters at St. Gregory's, Mortimer Road and Mowbray Road schools, for the E.C.; borough engineer.

Stretford. — Office extensions, for Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford; Russell Building & Contracting Co., Ltd., contractors, 165, Plymouth Grove, Manchester.

Sunderland. — Additions to Moores Stores, Back Tavistock Place; F. Carrell, architect, 32, Blandford Street, Sunderland.

Alterations and additions in Wreath Quay Road, for the Wearmouth Coal Co., Ltd.; G. T. Brown and Son, architects, 51, Fawcett Street, Sunderland.

Alterations to the Cricketers Arms Hotel and the Borough Hotel; W. and T. R. Milburn, architects, 17, Fawcett Street, Sunderland.

A.R.P. shelters at Kennedy's, Cobden Exchange; W. & T. R. Millburn, architects, 17, Fawcett Street, Sunderland.

Twickenham.—Three blocks of flats, King's Road, for T.C.; E. Weaver & Sons, builders.

Ventnor.—Branch library; I.O.W. Education Committee.

Wallsend-on-Tyne.—Hotel at Rosehill, for Arrol & Co., Newcastle: Hastie D. Burton, Ltd., contractors, King Street, North Shields.

Alterations to the Robin Hood Inn, for Ridley, Cutter and Firth, Newcastle-on-Tyne; Hetherington and Wilson, architects, County Chambers, Westgate Road, Newcastle-on-Tyne.

Completion of maternity and child welfare centre, for the T.C.; T. Clements and Son, builders, Jesmond, Newcastle-on-Tyne.

Walsall.—Factory extensions at Wisemore, for Reuben Craddock & Sons, Ltd.

Whitby.—Public shelters for the U.D.C.; surveyor.

Cleansing and first aid station, Falcon Terrace, for the North Riding C.C.; county architect, County Hall, Northallerton.

Wigston.—A.R.P. shelters at Wigston and South Wigston, for U.D.C.; R. Kind, chairman of A.R.P. Committee.

Wolverhampton.—Factory, off Guy Road; F. G. Roberts.

Rebuilding Roebuck licensed premises, Penn Road; A. T. & B. Butler.

Factory extension, Park Lane; Marcus Brown & Lewis.

Worthing.—Hall, Broadwater Road; E. J. Love, architect.

Baptist hall, Hillview Road; S. Walter.